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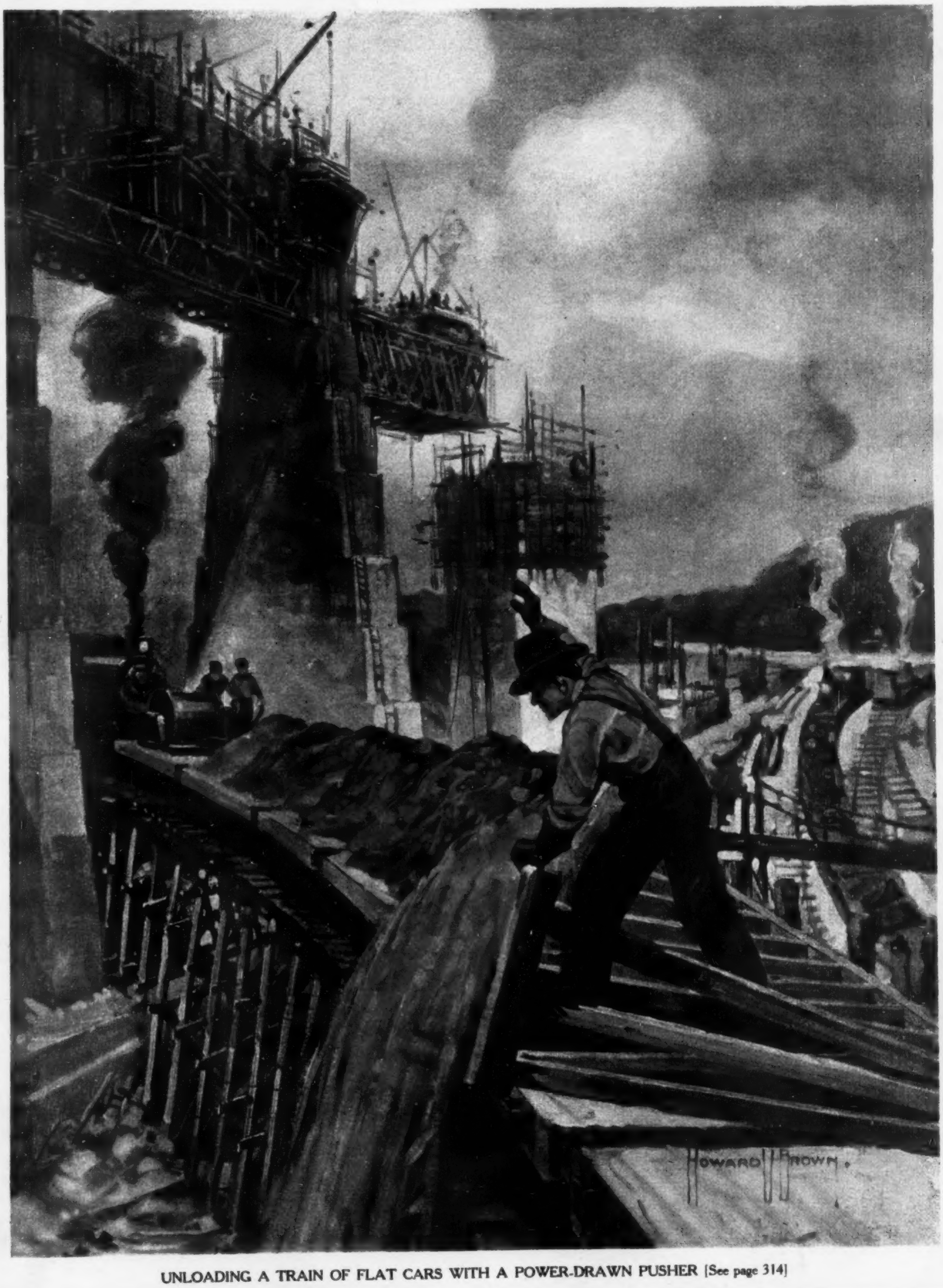

UNLOADING A TRAIN OF FLAT CARS WITH A POWER-DRAWN PUSHER [See page 314]

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Setting Volcanoes to Work

IN Central Tuscany, there is a region in which powerful jets of very hot steam issue from numerous cracks in the ground, spouting high into the air, and bringing up boric acid and other minerals and gases, which are reclaimed by the chemical plants in this district.

Until recently, the steam has been allowed to go to waste, except when used for domestic heating, but since 1903, Prince Ginori-Conti, president of the "Societa Boracifera di Lardarello," has been endeavoring to use these steam jets or *soffioni* as a source of power.

His first efforts were attended with moderate success, but when he drilled down through a hard stratum of rock, 300 to 500 feet below the surface, to the very source of the steam he was able to get an ample and constant supply. His bore holes were from 12 to 20 inches in diameter and were lined with iron pipe. They afforded an abundant supply of steam with a pressure of from two to three atmospheres, exceptionally rising to five atmospheres, and varying in temperature from 150 deg. C. (302 deg. F.) to 100 deg C. (212 deg. F.). There is no lack of supply if the bores are not located nearer than fifty feet from each other, and each can supply from 15,000 kilograms (33,000 pounds) to 25,000 kilograms (55,000 pounds) of steam at a temperature of at least 150 deg. C.

In 1906, this volcanic steam was first used in an ordinary steam engine of about forty horse-power, but the borax salts and other accompanying chemicals seriously corroded the machinery and interfered with constant and economic operation. Then the superheated steam was applied not directly to the engine, but to an ordinary multitubular boiler in which it was used in place of fuel to raise steam from ordinary water. Steam thus produced at a pressure of two atmospheres was passed through a superheater and then used in a 300 horse-power condensing steam turbine directly connected to a three-phase electric generator. This experimental plant worked successfully, supplying power to the works and the villages around Lardarello.

After the outbreak of the war its success led Prince Ginori-Conti to develop a power plant on a large scale, and accordingly three 3,000-kilowatt turbogenerators, working with a superheated steam at one and one-half atmosphere pressure, raised in specially designed and constructed multitubular boilers, were installed in 1916. The natural steam from the *soffioni* after heating the boilers is then utilized in the borax industries, so that the process is distinctly efficient.

The three-phase current is generated at 4,500 volts and is stepped up to 36,000 volts and transmitted along aerial conductors to Florence, Leghorn, Volterra, and other towns in Tuscany. In day time the power is used extensively in munition works and industrial establishments generally, and at night partly for lighting. The new undertaking has proved a great boon in industrial Tuscany, where the present war-price of coal ranges from $40 to $50 per ton, and as the region of *soffioni* extends for many square miles around Lardarello, this harnessing volcanic heat to an electric power house or central station makes possible the increase of available power to hundreds of thousands of horse-power at comparatively small expense and without recourse to foreign resources. Extensions are now under way increasing the output to 40,000 K. W. A similar utilization of volcanic heat is contemplated near Naples, where the ground at depths of 100 feet is almost red hot.

Such utilization of the internal heat of the earth, however, is dependent upon exceptional physical conditions, and it has occurred to an American engineer, Mr. Nathaniel B. Wales, that these conditions could be produced artificially. The increase in temperature of the earth's strata in proportion to its depth shows a mean average for the entire earth surface of one degree Fahrenheit for every 55 feet of depth. There are many regions, however, where this increase in temperature is far exceeded. Hundreds of areas are to be found in the United States where the temperature rises one degree for every 20 or 25 feet of depth. There is a locality near Boise, Idaho, where three wells driven to only 400 feet yield 800,000 gallons of water daily at a temperature of 170 degrees.

It is Mr. Wales's plan to sink a well-casing wherever the geothermic conditions are favorable until a stratum of high temperature, say 350 to 450 degrees Fahrenheit or higher is penetrated. Surrounding this shaft, a number of other casings would be sunk. Water would be injected into the heated stratum through the central well-casing and the head of the water would cause it to percolate through the surrounding strata from which it would absorb heat and be converted into steam. The steam then would rise through the circle of well-casings surrounding the central water shaft, and could be employed for power or heat. In this way, a large zone embracing several acres, could be utilized to form the active heating surface, drawing heat through the contiguous rock from an enormous radiant rock contact and allowing an inflow of heat from millions of tons of the earth's mass. The permanence of such an evaporative surface is amply proved by the maintenance of hot artesian wells, which are to be found throughout the world.

There are many areas in this country where boring not over 5,000 feet would give the necessary temperature and others of 1,500 feet less would supply all heat required. In some places the steam generated might have to be used indirectly because of the earth's salts held in suspension; but no doubt, these salts could very profitably be recovered and would add to the value of the installation.

The cost of maintaining a geothermic plant would be practically nothing. There would be only the first to consider—that of driving the wells and installing the engines and generators. Certainly in many power centers as well as in many mining centers, it would be far more economical to sink casings for subterranean steam generators than to be consuming coal continually and transporting the fuel hundreds of miles.

A plan for utilizing the internal heat of the earth for the generation of steam power

Use of Mean Sea Level for Elevations

THE Secretary of Commerce announces the appearance of a publication of the Coast and Geodetic Survey entitled *The Use of Mean Sea Level as the Datum for Elevations*, prepared by Dr. E. Lester Jones, Superintendent of the Survey. In this pamphlet is discussed the desirability of having a single plane for the whole country to which all elevations would be referred. This plane is that of mean sea level, which is supposed to be a continuous plane throughout the country from ocean to ocean.

For a number of years the Coast and Geodetic Survey has extended a network of elevations of high accuracy, inland from the coasts, with the elevations of its monuments all referred to mean sea level. The publication of the present report is to encourage the adoption and use of mean sea level as the datum for elevations by all civil engineers and surveyors. It is believed that the adoption of this plane will aid in the commercial and industrial development of the country. While to the layman the question may seem an academic one, it is far from being so. The use of a dozen different standards in a dozen different connections in the engineering activities of a single city is a matter leading at best to much superfluous work of reduction, and often to confusion and error.

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The United States Navy at War

THERE is nothing in our vast national activities more inspiring than the way in which our Navy has risen to the war call of President Wilson. Were it not that this world-conflict has taught us to think and speak in superlatives, a mere statistical statement of what the Navy has done, is now doing, and proposes to do, would be cause for amazement and incredulity. As the result of close personal touch, for over twenty years, with the Navy, we had reached a comfortable assurance that if, in some hour of stress, the nation should have to call upon this arm of the service for a supreme effort, it would rise to the call, seamen, officers and departmental administration alike, with a magnificent response.

Nor was there any reason to doubt that in the day of trial Congress and country would be found standing enthusiastically behind its Navy. Of the popularity of the Navy there was never any doubt; and although the question of naval appropriations has too often been made the sport of party politics, Republican as well as Democrat, we have never felt any doubt that, if politicians and people alike could once be awakened to the fact that only a strong navy could make permanently secure the peace of the country, and the great principles upon which our Republic is founded, the whole nation would rally to the support of the Navy with gifts unlimited of men, money and materials.

Well, the call has come, and right royally has the response been made.

In their order of importance, the principal elements that go to make up a great navy, are: personnel, fighting ships and a full exchequer, and in each of these the development of the past twelve months has been phenomenal.

Personnel. In a recent address of the Secretary of the Navy, at the graduation of ensigns in the Naval Reserve at Annapolis, Mr. Daniels stated that, whereas on September 1st, 1916, the total enlisted strength of the Navy and Marine Corps, including men and officers in the regular service and the reserve ranks, was 74,542, on Septmeber 1st, 1917, the number was 232,930. Said he, "So popular has service in the Navy become that the Department has been compelled to limit enlistment, because it could not build training stations and provide ships enough for the thousands of splendid youths who have flocked to the Navy."

Ships. Commensurate with the great increase in the personnel has been the growth of material, both as regards the ships in commission and the laying down and rushing to completion of new units. Today, practically the whole of the enlisted fleet is in full commission; and what this increase means may be judged from the fact that there are three times as many ships in active service today as there were six months ago. Moreover, as soon as President Wilson, realizing that the country was ripe for the movement, called for the enlargement of our Navy until it should measure up to the vast duties imposed upon it, a program of new construction was adopted which was larger than any which had ever been laid down, even in the British Navy itself. The naval appropriation was at once increased from the average of former years of $145,000,000 to over $312,000,000. That is a huge sum; but it represents only a part of what Congress has done; for since the 1st of August, 1916, Congress has appropriated for the support and increase of the Navy $1,344,184,896. Over and above that, the estimates pending before Congress carry an addition of nearly $600,000,000. The aggregate appropriation, therefore, in a little more than a year to make effective and impregnable the nation's first arm of defense is nearly two billion dollars. With such figures behind him, the Secretary was surely justified in saying to the Annapolis graduates: "If any man doubts that the American people are ready to wage this righteous war to victory, no matter what the cost, he need only consider the messages and acts of the President, and the legislation, and appropriation, revenue and bond bills that have passed Congress. They answer effectively and eloquently the suggestions of alien critics, that America is not enlisted with all its resources to free the world from the menace of Prussianism."

Great credit is due to the distinguished officers of the General Board of the Navy and the Naval Aid for Operations, who advise the administration as to policy, and to the Secretary himself, for the broad international spirit in which they have viewed the naval situation, and for the most loyal coöperation which they have shown in the plans and purposes of our Allies.

As we mentioned in our last issue, the Secretary himself has borne eloquent tribute to the unselfishness and completeness of this coöperation. Its material result has already been witnessed in the gradual suppression of the U-boat campaign, of whose ultimate defeat it is a sure pledge. Had the United States Navy been less altruistic, we might now be bending our energies exclusively to the construction of that large fleet of battleships and battle-cruisers, which had already been authorized before we went into the war. But, being in the war, the Navy has bent its whole energy to the construction of those units and the provision of that equipment which will be of most immediate service to the common cause. As witness the construction this year of over 300 submarine chasers of a new and more powerful type, designed especially for the work, and the appropriation even before these were finished, of the huge sum of $350,000,000 for the building of a fleet of destroyers, which will be larger and infinitely more powerful than that which we possessed when the war began.

Finally, a word as to the quality of these ships, and the officers and men who man and run them. No one can foretell the future; but we are disclosing no secret when we say that, if our battleship line should ever range up against the enemy, he will be treated at the longest ranges to a storm of fire, which, in rapidity, accuracy, and the uncanny way in which it clings to its ever-shifting objective, will be a most uncomfortable surprise to the enemy. For it is a fact that the methods of mounting, fire control, etc., which have been adopted and perfected in our Navy, have raised our target practice to a point of accuracy, even at the longest ranges, which has never been reached in our own, or, probably, in any other navy.

As to the officers and men, we know from personal testimony and a close acquaintance with foreign technical literature, that the officers of our Navy are held in the highest esteem, not only for their broad knowledge of the technique of their profession, but for the high character of their speculative contributions to naval technical literature. As to their seamanship and the quality of the crews, one has but to spend a few weeks on one of the ships of the fleet during its maneuvers, as was once the privilege of the Editor of the SCIENTIFIC AMERICAN, to be satisfied that, when our ships cast loose for battle, they will be handled with a skill, daring and resourcefulness that will uphold the finest traditions of the service.

Some Facts About Salmon

MR. JOHN N. COBB'S monograph on "Pacific Salmon Fisheries," a new and revised edition of which has just been published by the Bureau of Fisheries, is a nearly exhaustive treatise on one of the most interesting of industries. In a volume of more than 250 octavo pages, the author has presented a thoroughly readable account of this industry as it is found on the Pacific coasts of the United States, Canada, Alaska, Siberia and Japan. Without attempting to summarize so substantial a work, it may be worth while to set down here a few novel and out-of-the-way facts gleaned from its pages.

Salmon fisheries rank third in value among the commercial fisheries of the world, being surpassed only by oysters and herring. The Pacific coast of North America, from California to Alaska, is the seat of by far the most important of these fisheries. All the Pacific coast salmon belong to five species of the genus *Oncorhynchus*; but the steel-head trout, *Salmo gairdneri*, is commonly classed among the salmon by fishermen, and is therefore included in the report. The largest species is the chinook or king salmon, averaging about twenty-two pounds in weight. Much larger specimens are sometimes taken. Mr. Cobb tells us of one caught in Alaska weighing 101 pounds. The sockeye or blueback salmon constitutes the greater part of the canned product.

The life history of these fish has formed the object of much study and speculation, and some of its features are still mysterious. For example, the Fraser River, of British Columbia, where the sockeye is found in the greatest abundance, presents the phenomenon of a marked quadrennial periodicity in the run. The maximum run occurs the year following leapyear, and the minimum run in the year following the maximum. Puget Sound has a large run of humpback salmon every other year.

A great many experiments have been carried out for the purpose of determining the age at which the different species spawn, the rates of growth, etc. For many years the practice of marking and releasing salmon fry has been something like a fad on the Pacific coast. The commonest practice was to remove the adipose fin; but a great variety of other marks have been employed, including the entire or partial removal of other fins, the punching of a V or U out of the tail or gill cover, and sometimes tagging. These marking experiments were carried on so extensively, and above all so unsystematically, that when apparently marked specimens were recovered it was impossible to identify them, and so most of the efforts in this direction were wasted. Moreover, it is now well known that salmon are quite subject to the loss of fins or parts of fins by accident or disease, while in some cases the "marks" found on the fish are due to pressure from the twine of the gill net at the time of capture. In Alaskan waters the experiments have now been systematized, the Secretary of Commerce having directed that any persons desiring to mark and release salmon in those waters first consult with and obtain the written consent of the Commissioner of Fisheries or of the agent in charge of the Alaskan salmon fisheries. A more certain method of determining the age of these fishes has recently been borrowed from Europe. This depends upon the fact that the scales of the salmon are marked by series of concentric ridges, which occur in alternate groups of crowded and widely spaced rings representing years of growth somewhat after the manner of the annual rings in tree trunks.

One of the long-mooted questions concerning salmon related to the whereabouts of the fish after they left their native rivers and took to the sea. Recent discoveries have made it reasonably certain that the vast majority of salmon spend their lives comparatively near the coast, while many remain in the bays, straits and sounds all the time they are not in the rivers. The knowledge of this fact has led to practical consequences, especially in the case of the king salmon, which is now regularly taken not only by nets at the time of its runs but also by trolling at other seasons. Thus the length of the fishing season has been greatly extended.

The geographical range of the fisheries is also being enlarged. In 1912 and subsequent years a cannery was operated on Kotzebue Sound, in the Arctic Ocean.

It is interesting to learn that the artificial culture of salmon, so extensively practiced by our own Bureau of Fisheries, has attained immense proportions in Japan. In that country there are now 56 hatcheries, and the number of young salmon distributed by them amounts to more than 80,000,000 a year.

British Precision Work and American Tool-makers

IT has been said that it was not until shortly after the outbreak of the war that the British manufacturer got his first chance of manufacturing parts in large quantities. It is only fair, however, says a British correspondent, to admit that a large share of the credit due has to be given to the manufacturers of the light, high-speed machinery which has been imported in such large quantities since the outbreak of the war.

Previously most of the work was carried out by home-produced tools, and as there was comparatively little repetition work there was no inducement for any engineering firm to provide special equipment and appliances. Only a few, highly specialized on account of the nature of their work, paid serious attention to accuracy of measurement and interchangeability of parts. Of these, some even had their own individual standards which were not in accord with those of other firms producing similar articles.

Thus, a few years ago, lamp holders for incandescent bulbs, and lamp tops, both of which parts were being turned out by the hundreds and thousands, were not standardized, and were not interchangeable. Another instance is found in connection with screw threadwork. Eighty or ninety years ago, when screws were used in comparatively small quantities, every maker was a law unto himself over such details as diameter of screw, shape of threads, and number of threads to the inch. With a curious lack of foresight many makers went out of their way to produce screws and other small parts which were out of accord with those made by other firms, in order that no parts could be used on their machines other than those which were manufactured at their own works. Recent attempts at standardization have been successful however, not merely on their merits, but because means have been provided by which standardization could be attained. It is interesting to note that of the measuring equipment now used in the average British workshop about ninety per cent is of American make, and almost all the remainder has been produced on the Continent. It is said that not only are there very few machines in Great Britain capable of cutting an accurate screw thread, but that there is no British-made apparatus available and within the reach of the ordinary manufacturer whereby he can precisely measure the result, and much special apparatus cannot be produced without the use of American-made micrometer heads.

Astronomy

A Great Sunspot was visible to the naked eye during most of last February. The spot group, at the largest, was over 125,000 miles in diameter.

The 100-inch Mirror of the new Mt. Wilson reflector, the largest telescope in the world, was taken from the shops in Pasadena, where it was ground and figured, to the top of the mountain on July 1st. It was carefully packed in a large octagonal box, lined with paraffin to make it dustproof, and placed on a specially constructed truck geared to a maximum speed of two miles an hour. A pilot truck preceded the one carrying the mirror, and a number of men also went ahead to repair, if necessary, any weak spots in the road.

Rotation of Jupiter's Satellites.—Mr. R. L. Waterfield has communicated to the British Astronomical Association some observations on the markings of Callisto and Ganymede, the two larger satellites of Jupiter, made with the 10-inch refractor of the Four Marks Observatory. Comparisons more than a year apart of the positions of an apparently permanent marking on the former satellite were taken to indicate that this body always keeps the same face turned toward Jupiter. On Ganymede Mr. Waterfield saw a dark streak agreeing in every way with one described a couple of years ago by Mr. W. H. Steavenson. Its position corresponded well with Steavenson's rotation period for the satellite; viz., about fifty-nine minutes less than the period of revolution about Jupiter.

The Magnetic Survey of the Globe.—Up to the latter part of last September the cruises of the magnetic survey yacht "Carnegie," of the Carnegie Institution, and her predecessor, the "Galilee," had aggregated 224,449 nautical miles. On an average, magnetic observations at sea had been made at points 100 to 150 miles apart, representing a total of 3,250 stations. Magnetic observations had also been made at a great number of shore stations. The plan of the magnetic survey of the globe contemplates not only securing magnetic data in all regions where needed, but also determining the average annual changes, the so-called "secular changes" in the earth's magnetic state. In the marine work this is done by making observations at intersections with previous cruises of the "Galilee" and the "Carnegie," or with the tracks followed by the vessels used in recent antarctic exploring expeditions. "Repeat observations" have thus been made at eighty-five intersections of previous routes, the average time interval being approximately five years. Secular changes have also been determined at many land stations. The Carnegie Institution announces that the magnetic data accumulated by the end of 1917, will warrant undertaking the reduction of all results to a common date by applying the secular changes above referred to. It will then be possible to prepare a new set of magnetic charts of the globe on a more accurate basis than has hitherto been feasible. This step should furnish the foundation for important studies pertaining to the magnetism of the earth.

Recent Studies of Star Clusters.—According to a recent count by Melotte there are 245 star clusters, of which 83 are globular clusters, and 162 loose or open clusters. While the open clusters are almost all in the Milky Way and are symmetrically arranged with respect to it, the globular clusters are mostly confined to one hemisphere, the pole of which is in galactic longitude 296 degrees and galactic latitude —8 degrees. The fact that none of the clusters show any proper motion seems to prove that they are enormously distant, as the alternative that they are all moving in the same direction as the sun and at the same speed is too improbable to be considered. Moreover, no relative motion has yet been found in clusters, though the positions of the component stars in some of them have been measured by Barnard over a period of 17 years with the 40-inch refractor of the Yerkes observatory. The only exception to this statement is the case of two stars in the cluster Messier 92, and it is, of course, uncertain whether the two moving objects in such a case actually belong to the cluster. From considerations based upon the apparent magnitudes of the stars and their probable real luminosities, Shapley has provisionally adopted for the great cluster in Hercules (Messier 13) a parallax of 0.00003 sec. The apparent radius of this cluster is not less than 17 minutes of arc. "Accepting this result," says Shapley, "and the adopted value of the parallax, we find that the distance across the cluster is of the order of 1,100 light-years. To an observer on the nearer edge of the cluster, a star on the opposite side would have a parallax of 0.003 sec., and if intrinsically 100 times brighter than our sun, would still be nearly two magnitudes below the limits of visibility to the naked eye." The sun seen from any part of this cluster would, on the same basis, be fainter than a 22d-magnitude star; and it is probable that the entire galactic system to which our sun belongs would have about the aize and appearance of the Greater Magellanic Cloud as seen from the earth.

Science

A Directory of City Health Officers containing the names and official titles of the health officers in all cities in this country which had a polpulation of 10,000 or more in 1910, has been published by the U. S. Public Health Service.

A New Russian University.—A consular report from Petrograd states that the provisional government of Russia has decreed the establishment of a university at Perm, the metropolis of the northern Ural district. This will replace a present branch of the University of Petrograd.

A Textile Glossary is being compiled in the Division of Textiles of the U. S. National Museum and will probably be published before long by the Smithsonian Institution. The curator of textiles reports that this work has already proved of much assistance in connection with the cataloging of new materials received for exhibition and in answering requests from correspondents for definitions and identifications of fabrics.

Rare Animals from Australia.—Director Hornaday, of the New York "Zoo," states that Mr. Ellis S. Joseph has recently brought to New York from Australia the largest collection of rare mammals, birds and reptiles that ever came to America. Part of the importation has been purchased by the New York Zoölogical Society, and part by the Philadelphia Zoölogical Society, while other purchases are proceeding. Mr. Hornaday says that the total kangaroo collection at the garden under his charge is now the most extensive in the world.

The Ancestor of the Domestic Goat.—It has been generally believed that the different varieties of the European domesticated goat are all descended from the paseng, or bezoar goat (*Capra ægagrus*). During the laying of a water main at Iloczow, in eastern Galicia, in 1913, fairly well preserved skulls of fossil goats were found, and one of them was submitted to Dr. Adametz of Vienna for examination. It evidently belongs to a hitherto unknoown extinct species, which has been named *Cpara prisca*. The conformation of the skull is quite different from that of the skull of *C. ægagrus*, and of its subspecies, the Cretan goat and the wild goat of the island of Erimomilos, but is identical with that of the so-called Jura wild goat, which was proved by Lorenz-Liburnau to be merely the domestic goat reverted to a wild state. The skull of the extinct species also closely resembles that of most of the European domesticated breeds. It thus appears that most of the latter are probably derived from *C. prisca*, though a few breeds, such as the old Alpine breed of Salzburg, are evidently descended from *C. ægagrus*.

Lake of the Woods Survey.—The International Joint Commission has made a final report on the investigation begun in 1912 of a plan for maintaining the Lake of the Woods (on the border between Minnesota and Canada) at a level which would secure to the inhabitants on both sides of the boundary the most advantageous use of the waters of the lake and of the rivers connected with it. Comprehensive surveys were made of the Lake of the Woods, Rainy Lake and the principal lakes tributary to the latter. The level recommended for the Lake of the Woods is 1,061.25 feet above mean sea-level. This will entail some flooding of adjacent lowlands and some damage to agricultural interests, but it is provided that the owners of such lands shall receive full compensation. Water power is recognized to be the dominant interest of the region, and the report provides for the use of the Lake of the Woods and the upper lakes as an immense storage reservoir for this purpose. In order to provide the necessary regulation of the lake, the commission recommends the enlargement of the outlets at Kenora, at a cost of about $175,000.

The Shifting Sands of Astrakhan and the measures taken by the Russian government to deal with this problem form the subject of a memoir by J. G. Firstov, published last year in Petrograd. Ten million acres of the province in question are covered with shifting sands formed during the nineteenth century and subsequently. These sands have been spreading at the rate of 100,000 acres per annum the result being the transformation of good pasture land into a barren waste. The principal cause is over-grazing; flocks and herds are kept so long in one place as to result in the complete destruction of the turf. Poor agricultural methods are also partly responsible. About the beginning of the present century the government undertook measures of control and reclamation, and between 1904 and 1909 an area of about 46,000 acres was brought under cultivation. In 1913 a special service was organized to deal with the question. The province was put under the charge of a chief forestry officer and divided into six districts, in each of which a subordinate official was appointed to superintend the work. At the time of writing good progress has been made in planting soil-binders and growing herbaceous crops, but it was still problematical whether the province was adapted to the establishment of forests.

Invention

A Typewriter Key-Striker.—Comprising a rod of rigid material forming a hand grip and provided at one end with a laterally disposed finger having a striking peen shaped to engage a single typewriter key, the typewriter key-striker recently patented by Roger W. Babson of Wellesley Hills, Mass., is of interest. Primarily, the key-striker is intended for typewriting in the open during cold weather, when the typist must wear gloves.

Paper Removing Machine.—For facilitating the removal of paper from any surface, Alvin B. Russell of Brooklyn, N. Y., has patented an interesting, electrically-driven tool. In principle his device calls for a sharp, flat blade, which is rapidly reciprocated by means of an electric motor fitted with an eccentric movement. The motor is mounted in a wedged-shaped casing, and the blade slightly protrudes beyond the front edge. A handle is provided at the blunt or rear end of the wedged shaped body.

Another Sword-Pistol.—Although several types of combination sword-pistol have been described in this column before, there appears to be no limit to the variety of designs produced by American inventors in this field. The latest design is that of Anton Ramocki of North Tonawanda, N. Y., who suggests a sword the hilt of which carries the barrel of a revolver, the muzzle, and the firing mechanism. This latest type of sword-pistol is fired by pulling a trigger located next to the handle.

Steaming Clothes at Home.—No longer should it be necessary to send garments away to be steamed, at a cost of several dollars; at least, not if the steaming apparatus invented by Nathan Rubenstein of New York city, is widely introduced. Making use of a garment form, Mr. Rubenstein attaches to the pedestal below a steam-distributing chamber, a tray for catching the water formed by the condensed steam, and a pipe leading to some suitable form of steam generator. Thus any garment placed on the form can be readily steamed by anyone, with the minimum of care and trouble.

A Cartridge Carrier for the Single-Shot Gun.—Why is a single-shot firearm at a disadvantage at times? Merely because of the length of time required to prepare it for the next shot. And when the cartridges are kept in the hunter's pockets or in a cartridge belt, the length of time required between shots is all the greater. With these facts in mind Jesse C. Chappell of Samantha, Ala., has devised an ingenious cartridge holder or carrier which fits below the trigger of any rifle or shot-gun. The carrier consists of two U-shaped clamps of such size as to hold securely two cartridges. Thus the hunter, when pressed for time, can readily pluck a cartridge from the carrier below the trigger and place it in the breach of his gun in the minimum of time.

An Inexpensive Premium Idea.—With the ever-increasing price of materials and handiwork, businesses which require premiums in selling their goods are confronting a serious problem. At least they were until recently, when a new idea in premiums made its appearance in the form of short strips of material and metal studs. Any material such as felt, woolen goods, silk, cloth and leather can be cut by a special die and stamping press into two lengths, one slightly longer than the other, These strips have holes punched in them at equal distances. By means of metal studs these strips can be joined into various shapes and designs, and since the strips and studs can be made up in different colors, almost any combination of color and design can be attempted. Penants, pillow tops, table covers, flags—indeed, almost any article can be made up with the strips and studs to the never-ending interest of children and adults. Inexpensive and attractive, these strips and studs can be given away as premiums with various goods, the standard premium consisting of two strips and three studs.

Improving the Phonograph.—A number of inventors are at work on the phonograph reproducer at the present time, as attested to by the numerous patents constantly being issued on this class of inventions. While many of these patents are more in the nature of slight refinements, particularly means of twisting the mounting of the reproducer so that it can be used for hill-and-dale and for lateral cut records at will, a few of them represent a genuine effort to improve the tonal qualities of the conventional disk phonograph. Several patents call for means of adjusting the tension on the reproducer diaphragm; and in view of the noticeable variation in the tonal qualities of some phonographs due to changing atmospheric conditions, this should prove a most important innovation in many existing types of reproducers. A most ingenious idea is that of James G. Nolen of New York City, who proposed the use of the usual diaphragm together with an auxiliary diaphragm, the two being connected by a wire in the center of which is attached the arm from the needle. Mr. Nolen also provides a means of drawing the disks toward one another according to the average pitch of sounds to be produced.

The New War Truck

How American Manufacturers Have Coöperated to Produce a Standard Machine

By C. H. Hardy

IF competition is the life of trade, coöperation may be the soul of progress. At least, the new War Truck, as the Quartermaster Department calls the Type B truck evolved for its use by the Society of Automotive Engineers, the leading engine, chassis, transmission, rear axle and parts designers of the country, with the active coöperation and supervision of Gen. Chauncy B. Baker, Q. M. C., and the Automotive Products Section of the Council of National Defense, appears to demonstrate this fact.

There seems no doubt that this truck begins a new era in motor transportation. It may not be the "ultimate truck" but it represents so advanced a practice, so many ideas of so many makers which were being either worked out for the future, or, already perfected, being held for future production of commercial engines and cars, that it can hardly be considered as less than revolutionary.

The new "Liberty" truck specially designed for the U. S. Army

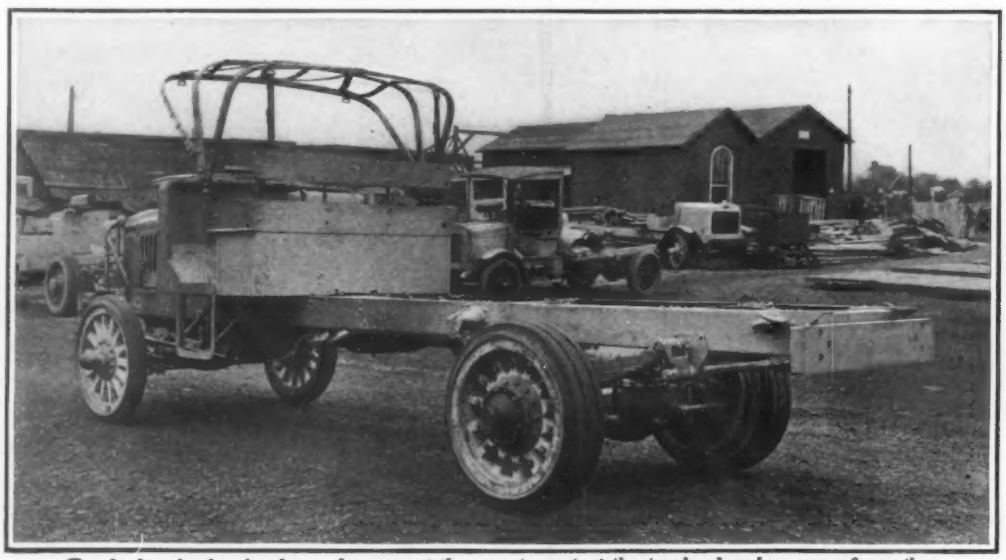
The story of its design is as simple as it is inspiring. High salaried representatives of the leading automobile, engine and parts manufacturing companies were called together by the Society of Automotive Engineers, told one story and asked one question.

"The success of modern war depends on no one factor more than upon successful, speedy, economical and certain transportation of supplies. Other things being even approximately equal, the army with the best transportation wins."

That was the story. Follows the question:

"You gentlemen, together, know more about trucks, engines, and parts than the rest of the world put together. Are you willing to sink personal pride and prejudice, are you willing to forget trade and money making, are you willing to pool your knowledge and make for the government a standardized truck which will be to all other trucks as the racing car of today is to the racing car of 10 years ago?"

"Very simple," was the answer. It was a universal assent, followed by conference after conference, design after design, labor after labor. Engineers who had not done more in detail than think and direct for years, bent over drawing boards, cross-hatching. Designers who had hitherto guarded the secrets of their plans with locked doors and trusted employees talked freely to their competitors. One engine maker who had designed a combustion chamber, tested it and perfected it and found it something ahead of all others and who was planning to use it on 1919 or 1920 cars handed it over without a thought. Every man with a pet oiling system brought it to conference and puzzled over the fact that the others were as successful as his, whether it worked at 100 or 50 or 20 or 2 pounds pressure, until experiment and calculation showed that all were successful because all were passing the same amount of oil per revolution regardless of pressure. Rear axle men forgot the rival claims of their respective companies, freely admitting the other fellow's good points, and together produced a rear system which combined the best of all. Lubrication, ignition, governing, transmission, cooling, springs, weight distribution—all received the attention of the men who made the best in the world, and were designed, not by one, but by the cream of the profession, acting in concert, without pay, without hope of reward, without any thought save that Uncle Sam needed a real truck, and that it was not their patriotic duty, but their patriotic pleasure to give him all they had.



Truck chassis showing heavy bumper at the rear to protect the truck when in convoy formation

Result, the War Truck. After January 1st, no other Type B truck will be supplied our army. In a short time—a shorter time than European experts believe a manufacturing possibility, the whole army will be supplied with this one type of truck.

What this means, even were the truck just an ordinary vehicle, only those who have worked out transportation problems at the front may know. In Paris a huge 12-story building, filled with card systems and hundreds of clerks, cares for the stock of over 2,000,000 different *kinds* of parts required to maintain *all* forms of motor transportation on the Allied fronts. *One* maker in England makes 17 different varieties of trucks and the English use all 17. Of course, there are hundreds of kinds of trucks in use, and all must have spare parts ready, somewhere.

There are approximately 7,500 parts in the U. S. War Truck and, if the army possessed a million of them, there would still be only 7,500 *kinds* of parts to carry for repairs and replacements.

The best driver, the best mechanician in the world cannot do as well with or as quickly for a strange truck as for one with which they are familiar. With thousands of trucks, all alike, not only need there be less drivers and less mechanics, but these can take their persons and their skill from point to point within the army, and be always ready to exert it to the maximum.

Competent observers have realized and it is generally accepted now as a military doctrine, that successful automotive transport means success at the front—failure in transportation makes even an overwhelming numerical superiority ineffective. There seems no question of the fact that the failures of the Russians were failures due to lack of supplies. The motor truck immortalized itself at Verdun, which, in the last analysis, was held because there was no failure of the trucking of munitions. Allied army officers freely admit that Germany might have reached Paris had her motor truck trains been as adequate for her purpose as was the rest of her mighty war machine and no one needs reminding of what General Gallieni, then Governor of Paris, did with taxi cabs and trucks in rushing men to the defense of the French Capital.

So American army men are jubilant over the fact that we are to have—are now getting—not only plenty of trucks, standardized trucks, strong, well made, efficient trucks, but trucks which, in power, economy, simplicity, sturdiness and "fool-proof'ness," are several jumps ahead of any hitherto produced.

Naturally, minute details are not being published. Unquestionably the War Truck, which is a *war* truck because produced by the necessities of war, will become the Peace truck for hauling within its range. Called a three-ton truck, it can carry up to five tons without undue strain. What questions of patent rights, of the use of the hundreds of points of superiority of many makers, pooled in this one supertruck, will be raised when it comes to making this truck for commercial use, can be settled later. At present, intimate dimensions are not being given out. But there are some facts which there is no reason to keep secret.

At the present writing, two completed trucks are on their way over roads from the manufacturers to Washington. The assembler of one of them states the total weight of the chassis without body is 8,200 pounds. A 1,600-pound body brings the total to less than 10,000 pounds. The engineers under orders to build a stout, robust truck suited to the extreme services of war have not striven for great lightness, but neither have they wasted metal. The engine weighs 1,012 pounds, rear axle, with hubs and brake-drums, 1,592 pounds, front axle, with hubs 352 pounds, transmission 233 pounds, clutch and case 103 pounds, frame without castings 653 pounds, front springs 148 pounds, rear springs 544 pounds. Weights vary from 40 to 50 pounds with different makers of the engine, and there are smaller variations with other parts and weights taken after production is well under way, will probably show cuts in these figures.

The engine, a real triumph in design, went together without a hitch. It was almost born off the draftsman table and had no "fine touches" before being put together and tested. Designed for using the heavier fuels it showed 58 horse-power at 1,350 r.p.m. and the torque curve was better than was anticipated. This, too, in face of the fact that engine makers, given blue prints, raced to see which could produce a War Truck engine running, first.

The different makers completed their tasks with great speed. The Continental Motor Co., one of the several particiapting in the program had an engine running 19 days and 18 hours after receiving blueprints. The Waukesha Motor Co. had an engine running in 11 days and 7½ hours from the time the blueprints reached its factory. They did not make all patterns for castings or all dies for forgings, some having been made previously but did do most of the machining. Four or five makers developed the engine by dividing the different parts between them, one making several parts not only for itself but for the others, thus saving time. The Continental Company made cylinders, gearcase cover and small parts such as pumps, bushings, etc. The Waukesha Company manufactured cylinder heads, crankcases, intake and exhaust manifolds, roller push-rods, etc. The Wisconsin Company made the lower part of the crankcase.

Patriotic manufacturers of both raw and finished products completed the units in record time. The Park Drop Forge Company worked continuously in three shifts and sunk dies for the crankshaft in seven days, an operation rarely completed in less than three weeks. The Werra Aluminum Castings Company produced the main crankcase pattern and cast it in five days, a three

(*Concluded on page 317*)

The Submarine Problem—XVIII.

The Destroyer, the Trawler and the Depth Bomb

THE student will search the history of the development of naval warfare in vain to find a period in which the eternal struggle between attack and defense has developed so many and varied mechanical appliances or such rapidly changing strategy and tactics in the use of them, as have been manifested in the fight between surface and sub-surface ships in the present U-boat war.

Before the war, except in the minds of some of the more alert and imaginative among naval men, defense against submarine attack was confined mainly to the torpedo net —and very few of our officers had much faith in that. In fact, in the few years preceeding 1914, the experience gained in naval maneuvers had served to fill the minds of the naval man with very serious apprehensions as to what would happen to a battleship line, if a fleet of submarines should ever get near enough to make a concerted attack.

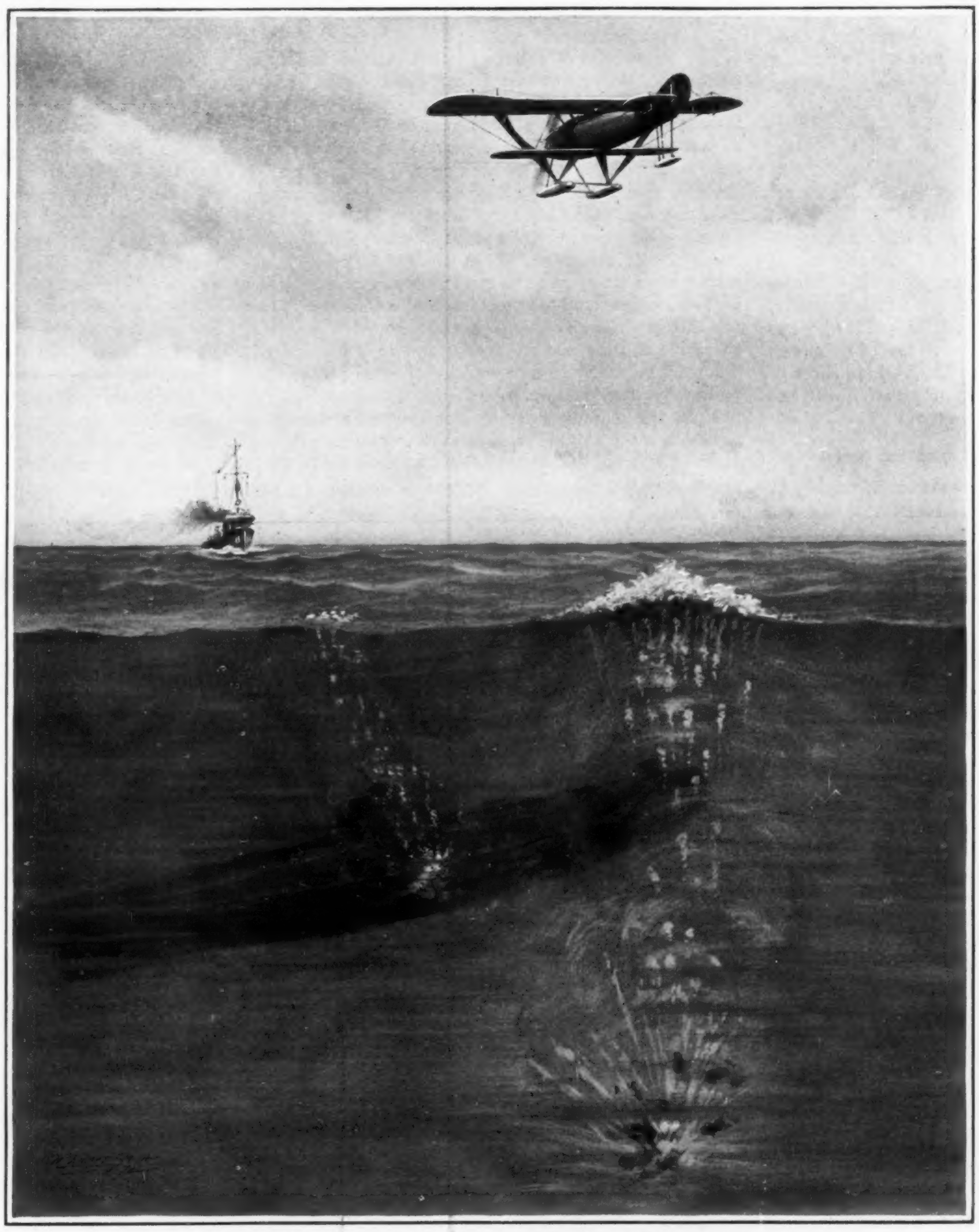
With the outbreak of the war, however, we began to learn very fast. The loss of the three armored cruisers, "Aboukir," "Cressy" and "Hogue," was a dearly purchased lesson which was at once given practical application. To loaf along at eight to ten knots on patrol, unconvoyed by destroyers, was seen to be nothing more or less than a policy of suicide; so was the approach of friendly ships of large size to render assistance to a stricken vessel. Slow speed and lack of a destroyer screen lost the first of these ships, and the stopping of the sister ships to rescue the crew inevitably sealed their doom. Forthwith, high steaming speed and the leaving of a torpedoed ship to its fate became the order of the day. A little later, the fact that 60 warships steaming at high speed and using the torpedo fought off and on for six hours in the Bight of Heligoland, without a single ship being struck, revealed the fact that high speed coupled with large helm area and quick turning ability were the best defenses against the new sea terror

And then the gun came into its own; so that even the slow freighter, provided it carried a piece which could outrange the enemy, was able to keep the U-boat outside of torpedo range and render it inexpedient indeed to engage in a gun duel at the surface. Then it came to be understood that if a way could be found to locate the submarine its capture or destruction would be certain; and so Great Britain gathered together in the waters around her coast that wonderful fleet of over 4,000 small craft—motor boats, converted yachts, tugs and tenders—which in the first two years of the war did such trojan work in hunting out and destroying the sea pirates. Ultimately into this strange contest there entered the seaplane, which proved itself to be an invaluable ally, not merely in detecting the enemy and bringing up the patrol fleet for its destruction, but also in direct attack by bomb dropping.

And thus it came about that the bays, roadsteads and more or less sheltered waters around the British Isles became too hot for the U-boat, so Germany set afloat much larger and more seaworthy craft, that swept out boldly on to the transatlantic routes and thereby largely utilized the efficiency of motor boat patrol. For when it comes to deep-sea work, the patrol boats must be large and stout and altogether seaworthy, capable of carrying a fair-sized crew and enough provisions to enable them to keep the sea for a couple of weeks on end. And so it has come about that out of the miscellaneous craft which have been engaged in fighting the U-boat, the choice for deep-sea work has narrowed until it now lies between two types—the destroyer and the trawler.

Speaking of the 10-knot trawler, the readers of the SCIENTIFIC AMERICAN will be surprised to learn that the trawler has a positive contempt for the U-boat—a self-assurance which has grown out of three years' conflict with them under all possible conditions. In the first place, the trawler is an excellent sea boat, stout in construction, broad of beam, with lofty bow and capable of taking everything that comes her way in the matter of wind and weather. Also her draft is so light that she has little fear of the torpedo, and she is stout enough to mount gun that can take care of anything the U-boat may carry. She is also very serviceable for the escorting of slow convoys, for salvaging vessels, for mine sweeping and for various other related duties.

The destroyer, of course, is the ideal anti-U-boat craft. It is big enough to stay at sea in all weathers. It carries an armament, in our Navy, of several four-inch guns; and with its speed of from thirty to thirty-five knots it can dash down upon a sighted submarine so swiftly as to put the enemy in immediate peril of penetration by gun fire, or of being sunk by the depth bomb.


A depth bomb does not have to hit a submarine to destroy it

There is just one device needed to enable the destroyer to rid the seas of the submarine pest in short order; for if someone will only produce a sound detector of sufficient range to enable a destroyer to find and follow a submarine when it is submerged, the thing would be done. For the submarine is primarily a surface vessel—in fact, it spends 90 per cent of its time on the surface. Its period of submergence in deep water is limited; and whenever a submarine that was under observation through listening devices came up, the destroyer would have it.

We illustrate in this chapter a weapon of which much has been heard during the past few months—the depth bomb. The depth bomb can be made in any size desired, and it is probable that the average type in use carries about 250 to 350 pounds of T.N.T., which is about the charge of the modern torpedo. The effectiveness of this instrument consists in the fact that it does not by any means have to hit the submarine to destroy it. Its destructiveness is based upon the fundamental fact that water is incompressible, and that the shock of detonating a mass of high explosive under water is felt immediately in all directions—the effect diminishing, of course, with the distance from the bomb. It will be remembered that in one of our earlier chapters on the submarine (SCIENTIFIC AMERICAN, June 9th, 1917, page 578) it was stated by Hudson Maxim that four cubic feet of T.N.T. at the moment of detonation produces 40,000 cubic feet of gas. Now, when a mine, or bomb, or torpedo warhead is detonated the expanding gases seek the line of least resistance. In the case of a torpedoed ship, this line leads into the hollow interior of the ship, the incompressible water forming an abutment in all other directions; but when a mine or depth bomb is detonated the line of least resistance is upward; and the gases cut their way quickly to the surface, carrying a fountain-like mass of water to a great height into the air. If the explosion takes place at a considerable depth, however, the resistance to the upper escape of the gases is greater and the shock transmitted through the water in all directions is proportionately increased. We illustrate this tendency; failing to blow up the surface of the ocean, the bomb must blow in the submarine.

The destructiveness of the bomb against the submarine will depend upon two things; first, the depth at which it is detonated, and second, the distance from the bomb to the submarine. Manifestly, then, it is advisable to detonate the bomb below the submarine as the shock transmitted will be proportionally greater than if it were above it, other things being equal. As to the distance at which an explosion would be absolutely destructive, rupturing the plating and sinking the submarine, Mr. Hudson Maxim writes us that if 500 pounds of T. N. T. were exploded deep under water within 125 feet of a deeply submerged submarine, it would completely destroy it. Smaller charges would, of course, have to be detonated proportionally closer to the submarine to secure destructive action.

Obviously it takes considerable skill to make a successful bomb attack of this character. On sighting the submarine the destroyer will make a dash for it at full speed, and estimating the depth and the course of the enemy, it will endeavor to drop a bomb so that it will either hit the submarine, or failing that, will be detonated below it and within crushing distance. The bomb, it is scarcely necessary to say, has an automatic means by which the depth at which the explosion takes place can be regulated.

Limestone Deposits in Bermuda

IT is understood that the quality of the lime made from the Bermuda limestone is very good and that the supply of limestone in the colony is practically inexhaustible. It is said to be quite soft before being exposed to the air, and is therefore easily crushed preparatory to burning. There are places in the colony where large quantities of limestone may be obtained.

An industry of the kind might be profitably worked in connection with shipping. If the producers of the lime owned and operated an auxiliary schooner or two, for example, they could not only transport their own product to the most available markets, but could easily obtain general cargoes for the return trips to Bermuda.

Reaching the Hundred Million

How War Work of the States is Coördinated by the Section on Coöperation

By C. H. Claudy

LONG before war was declared it was generally recognized by the Government that no preparedness campaign could reach any high degree of efficiency which did not include the winning of the patriotic coöperation of business, of industry, of civilian activities in general. To this end was created the Council of National Defense, which, with its advisory committee, makes available to the Government the best brains and the utmost coöperation of industry, and cares for a hundred special problems which the Government machinery of peace time was not calculated to solve.

The State Councils of Defense

War was declared on April 6th. On April 9th Secretary of War Baker, as Chairman of the Council of National Defense, issued a request to the 48 states of the Union that all form State Councils of Defense. This request has in every case been complied with. Where State legislatures were in session, such Councils have been created by them. In other States, they have been formed by appointment of the Governor. Invariably the outstanding feature of the creation of a State Council is the fact that it is non-military and non-partisan.

Were this country one State, and at that a small one, so many bodies would be unnecessary and confusing. To be sure, politically we are one people, under one government, with State rights subservient to national patriotism. At heart we are certainly one. But practically we are many peoples, with the many viewpoints which geographical and social differences necessarily create. The United States is made up of 48 States of assorted sizes and populations, with all sorts of climates, geography, resources, people, industries, politics, viewpoints, abilities, races. Each has a set of problems differing from those of the other 47. Nothing short of solution of these can mean effective coöperation with the Government in prosecution of the war.

The Section on Coöperation with the States

It is essential that we be one solid unit, not 48 or 100,000,000 units, if our conduct of this war is to be as ingenious, as efficient, and as effective as the American spirit can encompass. With these two ideas in mind the 48 State Councils of Defense have come into being. And to coördinate their activities there has been created, in the Council of National Defense, the Section on Coöperation with the States, George F. Porter, Chief of Section. Broadly speaking, the problems and the activities of the Section on Coöperation are three:

To make available to the government through the Council of National Defense the resources of the States, as coördinated by the State Councils.

To gain from the States, through their Councils, such coöperation in any matter as may be asked by the National Government.

To make available to each State Council of Defense the work, discoveries, methods and achievements of all the others, so that lost motion and unnecessary duplication of effort may be avoided and what is found good in one State may be swiftly adopted wherever else it will fit.

Fully to understand the invaluable work of the Section on Coöperation with the States, it is essential to glance for a moment at the marvelously varied activities of the various State Councils of Defense. As war is the most engrossing business in which a nation can take part, and as there is, seemingly, no department of human activity which has not some function in war, so there are few phases of war work which the States are not including in their 48 programs. It is obviously impossible to take up the work of each State Council on this brief page; only a few typical activities can be mentioned.

What the State Councils Are Doing

As a special solution of a special problem, Virginia's action in gaining the coöperation of her negro population is typical. The Virginia Council of Defense organized negro county councils as well as white county councils and had a representative of the negro council sit at each meeting of the white council and vice versa. When it came time to sell Liberty Bonds, an enthusiastic coöperation of Negro speakers, able to interest their race as no white speakers could do, resulted. The Negro is not normally a bond buyer in large amounts, but Secretary McAdoo tells those who assist in selling Liberty Bonds that it is far better to get twenty 50-dollar bonds sold than a single one of a thousand dollars.

California was threatened with a cyanide famine, fatal to both mining and fruit growing. Normally a problem for slow consideration by Chamber of Commerce or Board of Trade, the California State Council of Defense made it its business and collected enough to tide over the shortage.

Missouri had an uncomfortable number of citizens who had to be "shown" that patriotism was the best policy. A system of warning cards—white, blue and red—the last to be followed by a report to the Department of Justice, brought about a great change of heart.

Illinois, perhaps more than any other state, had an acute coal problem. Its State Council increased production, improved transportation, investigated prices and was about to take drastic action when Congress established the fuel administration—an action more promptly possible because of the work of the Illinois Council then it would otherwise have been.

Various State Councils have engaged in eighty-seven different activities, ranging from the formation of home guards, coördination of relief societies and extending aid to aliens, through recruiting and Liberty Loan work, labor supply and industrial mediation, to aiding in food conservation and carrying out what publicity work is desired by the National Government. No one state has had the same problems as its neighbors, though many have had similar ones.

The power of the various State Councils, and their subsidiary county or municipal sub-councils, varies widely as far as legal status is concerned. Some are merely advisory, others have vested in them powers as great as that of the legislature or the governor. But their legal right is a very small part of the power they actually wield. Because they are strictly non-partisan—in one case three bitter political enemies, who have fought each other tooth and nail, work side by side harmoniously and effectively in council work—appointments have been, almost universally, from among the best and biggest and most able men of the states. They are men with the ability to see all around a problem, to tackle it from the right end, and to get it solved. They are men who do things, rather than men who, some political power hopes, may be able to do something.

Until the waning summer commanded a let-up in such effort, the most important work undertaken by any of the Councils, and a work done by practically all of them, was the stimulation of food production by any and every means. The loaning of money to buy seed, the buying of tractors for community use, the persuading of southern farmers, especially small negro farmers, to substitute some food stuffs for the usual cotton crop, the establishing of boy's working reserves, the interesting of children in gardening, are but a few of the means employed to this end. Next in importance, perhaps, has been the labor stabilization work—the providing of employment bureaus, the offering of mediation to settle disastrous strikes, the supplying of farm labor.

Bringing the War Home to the Individual

At present no activity of any of the State Councils is regarded as of higher value than the information work. Louder and louder are the cries which go up from men in authority at Washington for education, education, education—education in regard to the war. What it is, why it is, what we must do to win it, why we must do it, the how and why of taxation, the need for care in food consumption, the prevention of waste, the need for every man, woman and child to buy a bond; in other words, telling every one who doesn't already know it that the government needs him—actively, not passively.

A few millions of our hundred millions read in a lot of magazines and newspapers. Most of us read one, sometimes. But the population, as a population, is not yet a solid unit in information about the war, in a universal spirit of patriotic endeavor to win the war. Canadian soldiers who have seen the thing through say we won't be until we face long casualty lists. A high official of the Council of National Defense believes that we need a spiritual awakening. And it is the State Councils which are helping to spread this doctrine, which are making available, to the last and smallest hamlet, to the most isolated and ignorant citizen, the needs and purposes of the Government in this, its hour of trial.

With such an enormous diversity of activity, it is evident that, in default of some central agency, the 48 State Councils would be like 48 banks without a clearing house. That agency is the Section on Coöperation with the States.

Where Coöperation Enters the Picture

Its labors are manifold. It persuades those who start new undertakings from Washington to use the State Councils and their already smooth working machinery, rather than to create new working bodies. It enthuses State Councils over new work originating in Washington, and for the success of which State coöperation is absolutely necessary. It makes immediately available to 47 states the action of Connecticut, for instance, in organizing the appointment of five policewoman to assist in the guarding of camps, or the fact that Indiana has completed a graphic census of licensed physicians by counties, or that Colorado has listed her tractors by counties and by horse-power, or that Pennsylvania has opened a new employment bureau to make her women available for war work.

These informatory reports are sent out whenever their general interest or special value warrants, but the greater part of such spreading of information is done at the request of some State Council. When a State Council of Defense wants to increase the scope of some special part of its work, it writes the Section on Coöperation. Back comes a letter, telling of this experiment by Connecticut and that experiment by Kentucky; a little later arrives an information circular, describing various plans carried through in other States; later still, perhaps, a bulletin requesting it to carry out throughout that State a program of work which so many States have found successful that Washington is hoping to standardize it, and, if possible, to make it nation-wide.

Food and Liberty Bonds

At the present moment, perhaps the most effective work the State Councils are being asked to do is in food conservation and Liberty bond selling, with general information, through the organization of speakers' bureaus and the distribution of the books supplied by the Committee on Public Information, a close third. There is no official agency—meaning government agency—which is available, for instance, for carrying the Liberty bond campaign home to the people, except the Federal Reserve system. Through this, of course, the coöperation of banks is assured and the first Liberty Loan was largely floated through the patriotism of banks and bankers. But by the use of the State Councils, reached through the Section on Coöperation, an entirely new line of information spreading and publicity has been evolved, the State Councils having means and ability to reach an audience the banks are unable to touch.

When it comes to the spread of information, the National Government has had to depend entirely upon the patriotism of newspapers and magazines and their desire to serve both their readers and their government. But no newspaper is going to fill its columns day after day with educational matter, when there is more news than space to print it. The National Government finds, in the State Councils of Defense and the Section on Coöperation, a ready means of making available, to all our hundred millions, the illuminating documents prepared by the Committee on Public Information. Through their bodies it is easy to organize and get in front of local audiences, local speakers who can talk upon war work and war problems from the local as well as the national standpoint. Incendiary fires in grain fields, for instance, and means of combatting them, interest southern states not at all, and the need for turning cotton land to garden produce isn't thrilling to the wheat grower in Dakota. But when the Dakotan hears an ex-governor or a famous lawyer or a prosperous rancher get up and talk about *Dakota's* need and *Dakota's* part in the war and what *Dakota* ought to know and where *Dakota* can help, he pays attention.

It is idle to contend that this nation is as yet united in war work and for war purposes as France is united, as England is united, or as our mutual enemy is united. The war hasn't come home, as yet. The war tax will wake up some who are best reached through the pocket book. Families who have sent son, brother or husband into the new army are alive to it. But as a nation we talk of "the" war—sometimes "our" war—never yet as "my" war.

No other agency is doing or can do so much, so rapidly, or so well, to arouse the people of this nation to the fact that this is a war for each individual to take to himself. No other agency could do so much for the National Government as the Council of National Defense has done, in making civilian brains and the country's industry instantly available to the parent government. Exactly what the Council of National Defense has done for the National Government, the State Councils are doing in making State resources available to the States, and thus, in turn, to the Government at Washington.

Undirected, such activities would duplicate, dissipate, run riot, become hopelessly involved and twisted. Wisely directed, by suggestion, information, enthusiasm, rather than by authority, state activities are proving themselves to be a tremendous mine of almost unknown and undreamed of strength.

Such is the function of the Section on Coöperation with the States. That its creation was a wise move, and its fostering placed in competent hands, is sufficiently evidenced by the greater and greater reliance which the National Government is every day placing upon its organization.

What Sixty-Three Hundred Degrees Will Do

The Rejuvenation of the Scrap Heap by Means of the Oxy-Acetylene Torch

IT is not so long ago that plant managers, superintendents and owners regarded anything thrown into the scrap heap as lost beyond reclamation. Two things have contributed more than anything else to change their opinions of waste. War has given the impetus, modern welding processes have furnished the means.

With prices of war material pushed to dizzy heights, the American factory man has begun to analyze his scrap heap. Usually he finds huge accumulations of damaged or worn machinery, tools, "short ends," etc. Face to face with labor shortage, metal shortage, and the time factor, plant owners are calling upon the welder to reclaim these worn and damaged machines and broken tools and put them back to work earning profits. Of the many instances of this sort of thing which might be gathered we mention a few.

Recently an engineer for an oxy-acetylene concern made an investigation in a western field. At one big mine he found, in the scrap pile, dies for drill sharpening worth nine dollars each which could be welded and put into service at a cost of about a dollar apiece. From a year's accumulation of scrap enough of these were dug out to furnish a three months' supply of dies, at a time when the mine owners were very dubious as to the possibility of securing new ones.

In another place this engineer found a year's supply of tram buckets with broken bottoms. These, worth 40 dollars each, were welded at insignificant cost. In the same scrap heap he unearthed a three months' supply of stamp stems, and enough short ends of tungsten steel to last a year when welded together. Crusher plates of manganese steel, worth 20 dollars apiece, had been scrapped because they were slightly too big for a new installation of machines; and these were cut down by the oxy-acetylene process, and restored to use at an enormous saving.

A big milling concern rummaged its scrap heap and found a lot of gear wheels which had been discarded because teeth were broken out. At a trifling cost new teeth were fused into the castings, making them as good as new.

A railroad company had a big accumulation of scrapped driving wheels for locomotives, most of which had cracked spokes. A saving of thousands of dollars resulted from the use of the welding process on these, without mentioning the increased train movement made possible by restoration of discarded engines to service.

On another road a locomotive was towed into the shop with a badly damaged cylinder. The first diagnosis made the case out as hopeless, so far as repair was concerned. But acute shortage of rolling stock led to a rehearing; the welder was called in and at a cost of twenty dollars made the $750 cylinder as good as new.

A paper company was badly in need of metal cores for winding rolls of paper. Tube mills were far behind in their orders, and there was slim chance of getting any action in that direction. But out of a three years' accumulation of broken and defective cores the welder reclaimed several carloads of good tubes by the simple process of cutting them into short perfect lengths and welding these together.

Still another railroad was on the point of tying up several hundred locomotives because of the impossibility of renewing defective boiler tubes. Digging into a five years' accumulation of junked tubes, however, brought forth more than enough salvageable pieces to put all the dead engines into commission. Here is another case where the direct saving does not begin to indicate the value of the reclamation work effected.

High speed steel is growing so scarce that many concerns are meeting their urgent needs by using the oxy-acetylene torch to weld short ends together into pieces large enough to be used again in tool making. This process has become so general as to require little illustration; but a rather interesting development of the idea involved is seen in the case of one electroplating plant which has begun to weld the stub ends of nickel anodes. These were formerly sold at a junk price to get rid of them; but now, by an expedient quite similar to that of sticking a small piece of soap, left from the old bar, upon the new, they are used up with 100 per cent efficiency.

One of our leading automobile makers has turned the welding process to account in reducing the loss from defective castings. Many of these, rejected through minor disabilities, can be fixed by the welder—slight holes filled, thin spots built up—at a much lower cost that that of melting and recasting. This idea is surely one for general application.

One concern manufacturing chain belts was handicapped in delivering a rush order because a careless workman, in roughing out some large links, took off too much metal. The oxy-acetylene process was called into play to build up these pieces again, and the work was accomplished in a few hours, so that the order was delivered on time.

It will be seen from all these examples that saving hundreds and thousands of dollars every year through careful analysis of the scrap heap and castings returned for remelting is not a theory, but an actual fact being demonstrated all over the country. Under the hands of the oxy-acetylene welder it seems that metal almost takes on the character of the putty with which the sculptor does his preliminary work, and which can be shaved off and built up, joined and molded and worked in any desired fashion and as many times as may be convenient.

Nor is this process necessarily restricted to any one or several metals, as some might suppose. Any kind of metal at all is amenable to the oxy-acetylene treatment—steel, cast or wrought or sheet iron, brass, bronze, copper, aluminum, nickel, even gold, silver and platinum —all these can be cut or welded at pleasure. At the heat of 6,300 degrees Fahrenheit produced by combustion of acetylene in oxygen every one of these metals fuses and runs together, acquiring in truth a consistency even softer than that of the sculptor's putty to which we have compared them.

America is said to have the biggest scrap heap in the world; but as conservation is the scrap heap's worst enemy, it is expected to be greatly reduced before the war is over. Perhaps by that time the nation will have learned thoroughly the lesson of how to convert scrap metal of all kinds into gold and silver dollars.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Air Bubbles for Nullifying Submarine Explosions

To the Editor of the SCIENTIFIC AMERICAN:

I have recently made some experiments in a small way to test some of the suggestions that have been made in your valuable paper in the course of recent discussion on torpedo defence. These were as follows:

A 45-caliber Colt blank cartridge was inserted in an iron block having a bore as long as the shell and mounted in the middle of a barrel filled with water so that it could be easily exploded. In this experiment No. 1, the effect of the explosion resembled the striking of a 10 pound sledge hammer on the floor; the barrel rocked slightly but no water was thrown out.

In experiment No. 2, a thin rubber air bag was placed immediately under the cartridge, which had about one pint capacity. The arrangement was such that upon explosion the blast of the cartridge would enter directly into the submerged air bag. The result was a shock of less suddenness but of such volume as to sound like a heavier but slower striking sledge hammer. It almost upset the barrel and blew part of the water up out of it.

In experiment No. 3, a jet of air was set free immediately under the cartridge, causing a kind of foam or at least a myriad of air bubbles and walls of water between them, into which cellular mass the charge was fired. The result was almost complete nullification of the shock. Compared to the first experiment, it was like hitting the floor with a padded one-pound hammer.

Commenting on the experiments, No. 2 illustrated the tremendous destructive power of an explosive charge as in a torpedo or mine when it is backed by a solid unyielding body of water on one side, and a yielding medium permitting full expansion of the gases, as the air-backed hull of the ship, on the other side.

It appeared in this instance, that not only did the gases have a chance to expand fully, helping to bring about complete combustion, but time enough was allowed to overcome the inertia of the resisting media on a more voluminous scale.

In experiment No. 3, there appears to be conclusive evidence of the feasibility of Hudson Maxim's idea of resisting explosions by an intermediate arrangement of air and fluid cells. The intervening cell walls of water in the air jet experiment were shattered and atomized, forcing the energy of the explosion to do a large amount of mechanical work. The air bubbles of course did act as a cushion to a certain extent but the hot gases appeared to be instantly cooled by the very large cooling area of the atomized particles of water.

In my estimation, the explosive force of a mine or torpedo in direct contact, is so ponderous that if it be allowed a solid sea backing with the interior of the ship as the only path of least resistance, it will crush in a cellular protection of water and air even though very deep.

I believe, however, that if the density of the surrounding water could be reduced at least for the critical moment so that the modified Maxim idea may be made to work outside of the ship as well as inside, a surprisingly small amount of damage would be done by an ordinary mine or torpedo explosion.

To produce the cellular effect outside of the ship, no draught resisting outrigging would be needed. A series of air nozzles could be arranged near the bilge of the hull, running along its entire length, but equipped with a system of valves for selective discharge. Air could be stored under pressure in tanks. Since it is possible to see the approach of a torpedo, a volume of air could be released in the vicinity it is about to strike. It is in the foam caused by the air discharge that the major part of the explosion would occur. It would then become a yielding medium to relieve to a large extent the penetrative force against the yielding hull of the ship.

New York. ALBERT F. SHORE.

"To the Kaiser"

To the Editor of the SCIENTIFIC AMERICAN:

I want to thank you for the timely and vigorous editorial in the SCIENTIFIC AMERICAN issue of September 8th, 1917 entitled, "To the Kaiser." I hope that it will be widely spread and read. I have seen it reproduced in one of the large daily papers of Philadelphia, and I think that a translation of it sent through the German Empire ought to open the eyes of a sadly misled people. A careful perusal of it might benefit a class of citizens who call themselves Americans, but whose words and acts, are to say the least, un-American and un-patriotic.

Pittsburgh, Pa. THOS. D. GILLESPIE.

Charles Forbes, M.D.

THE world of invention has lost a worker of ability, and the SCIENTIFIC AMERICAN one of its subscribers of longest standing, through the death on October 2d of Dr. Charles Forbes, of Rochester, N. Y. Dr. Forbes was always able to find time, in a particularly active lifetime devoted mainly to medicine and medical instruction, to give free play to his interest in all things photographic and electric. During a connection of many years with Columbia University he designed more than forty pieces of laboratory apparatus in these three fields, many of which are still in general use. In addition to this and to his work in dry-plate making, he is perhaps best known as the inventor of the gauze bandage, drain and sponge roller which have been adopted as standard by the American Red Cross Society, and as the designer of the first individual communion cups—a measure of cleanliness coming with peculiar appropriateness from a physician.

Uncle Sam—Employment Agent for Engineers

IN normal times when an employer is in need of help he has only to post a notice in front of his establishment to secure the necessary hands. At times, however, he requires men of special qualifications who are not only skilled mechanically, but who also know the underlying principles of their occupation. Such men are never abundant, and frequently are quite scattered; hence much valuable time is lost to the employer and the available man in finding each other.

With this in mind, the United States Department of Labor recently created, as a part of its employment service, a Division whose function it is to aid the employer in obtaining suitable help, and professional persons in securing suitable employment. While intended to embrace all professions, attention has thus far been confined to those of teaching and engineering. The methods of the Division are thorough, and no service is rendered the applicant until the Division has learned, from persons familiar with him, that he is qualified as to training, experience, and personal qualities for the position he seeks. When an applicant is recommended for a reported vacancy, the employer is given an opportunity to examine the data gathered in the course of this investigation, thus effectually preparing for the personal interview, for which facilities are provided in the offices of the Division.

Employers and professional engineers everywhere are invited to avail themselves of the services of this Division which are entirely free. Employers in reporting positions are asked to state the nature of the position, its duties, requirements, etc., the probable salary, and probable duration of employment. Applicants for registration should indicate in the first letter the nature of the position desired so that the proper blank may be furnished. All communications should be addressed: Teachers and Professional Service Division, U. S. Employment Service, 845 South Wabash Avenue, Chicago, Ill.

Panorama of Ashokan reservoir, the artificial lake from which New York City gets its mountain water

Meeting New York's Insatiable Demand For Water

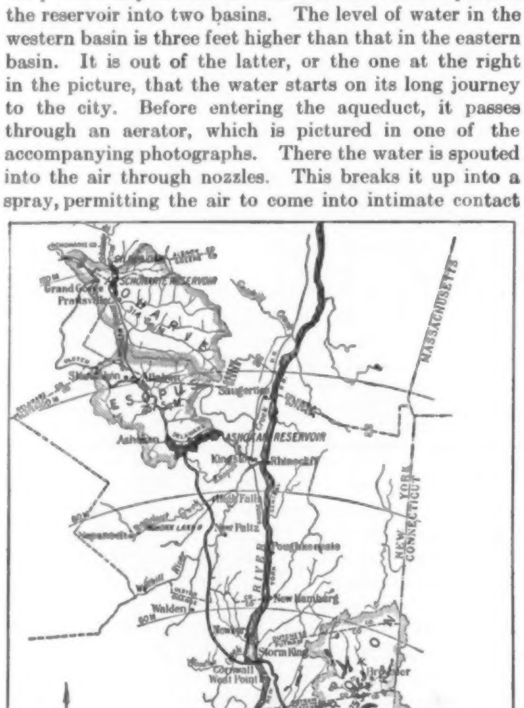
Running a River of Mountain Water Into the City

FOR the last six months, a stream of water has been flowing out of the Catskill Mountains into the heart of New York city, supplying Brooklyn, Richmond and large areas of the Bronx, Queens and Manhattan. To be sure some Catskill water has been used by the city since 1915 but the flow has been uninterrupted since May, 1917. On the 13th of this month, the work was officially turned over to the city with suitable ceremonies. This marked the completion of one of the world's greatest engineering projects, which has been pursued for the past 10 years. It involved the construction of deep rock tunnels of unprecedented length, enormous concrete dams, huge steel siphons and even a pipe line laid in a submarine trench.

The Catskill aqueduct extends 120 miles from the great artificial lake at Ashokan to the Silver Lake Reservoir at Staten Island. It can now be depended upon for at least 250 million gallons daily in the most prolonged series of dry years likely to occur. New York's demands for water seem almost insatiable. The weight of water it consumes each day is about eight times the weight of its inhabitants. The city is at present using 615 million gallons a day, but as its population is increasing at the rate of 157,000 per year, and as each person will require about 100 gallons of water per day, it will be necessary, in time, to increase still further the supply of water. Already steps are being taken to develop a second Catskill watershed by building a dam across the Schoharie Valley at Gilboa, and turning the waters back through a tunnel under the Shandakin Mountains to the Ashokan Reservoir. When this watershed is developed, 500 million gallons of mountain water will flow into the city each day.

It was a bold stroke of engineering, this of building a vast lake in the Catskill Mountains, and constructing an artificial riverbed which would carry these waters down to a city 100 miles away. By building 5½ miles of dams and dikes in the Esopus valley a reservoir was made with a total capacity of 132 billion gallons. This is too large a figure to give us any conception of the size of the reservoir. It may help us to conceive of the amount if we make a mental transfer of the water impounded at Ashokan to New York when we shall find that it would be enough to cover the entire island of Manhattan to a depth of 30 feet. The lake is 12 miles long with an average width of a mile, and it covers the sites of seven villages. Two thousand inhabitants were moved from the submerged area and 2800 bodies were removed from the 32 cemeteries found in this locality. The building of the lake involved the relocation of 11 miles of railroad track, and 64 miles of highways had to be discontinued.

A general view of Ashokan Reservoir from High Point Mountain is pictured herewith. At the right of the picture may be seen the weir and dike which separates the reservoir into two basins. The level of water in the western basin is three feet higher than that in the eastern basin. It is out of the latter, or the one at the right in the picture, that the water starts on its long journey to the city. Before entering the aqueduct, it passes through an aerator, which is pictured in one of the accompanying photographs. There the water is spouted into the air through nozzles. This breaks it up into a spray, permitting the air to come into intimate contact



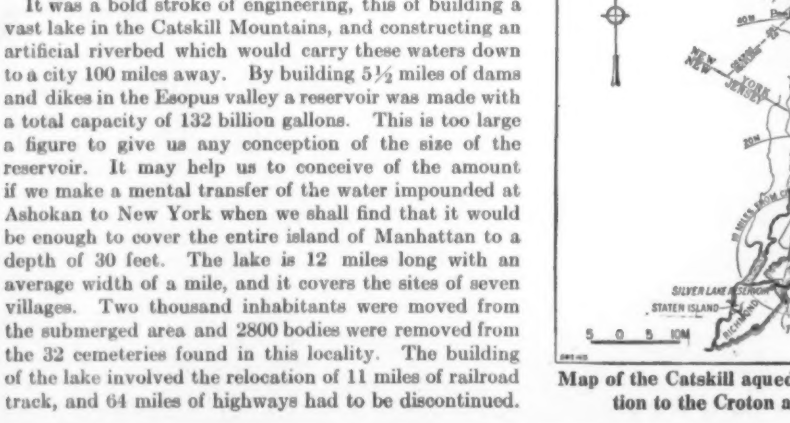
Map of the Catskill aqueduct system showing its relation to the Croton and Ridgewood systems

with the water and rid it of microscopic vegetable growths and animal organisms which would be liable to befoul the aqueduct itself and give an unpleasant taste to the water.

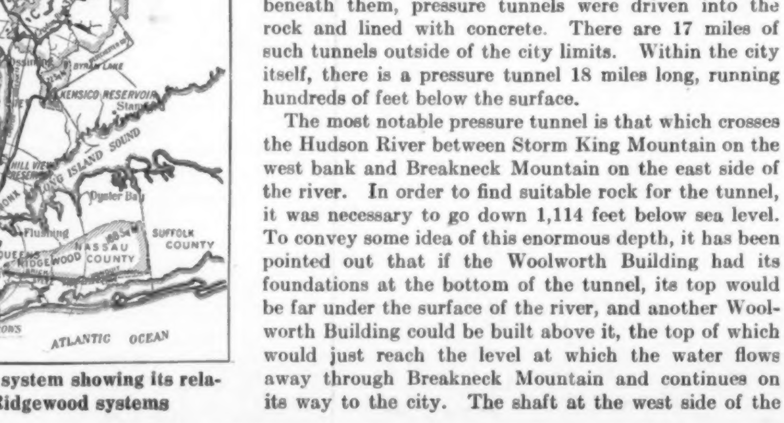
On its way to the city, the water has to pass through long lines of steel and concrete conduits, and through many tunnels driven under mountains and rivers. The water is driven on its entire course by gravity, for the Ashokan Reservoir has a head of 590 feet above sea level. Had it been necessary to pump this quantity of water to the city to the same high gravity pressure, the cost would amount to something like $2,000,000 per year. As it is, the water is carried into the city without any cost of transportation, and such small amounts of power as are required for the aqueduct equipment and lighting some of the structures are generated by the fall of the water from the reservoir into the aqueduct.

Fifty-five miles of the artificial river passes through a cut-and-cover type of conduit. This is constructed of concrete without steel reinforcement and covered with an earth embankment. One of our illustrations shows very clearly the construction of this type of conduit in its various stages. It is of horseshoe shape in cross-section measuring inside, 17 feet high by 17½ feet wide. Where hills or mountains cross the line of the aqueduct, tunnels have been driven through them, which are also of horseshoe shape, but somewhat smaller than the cut-and-cover conduit and of a steeper gradient to compensate for their smaller waterway. There are 14 miles of such grade tunnels. Steel siphons carry the water through some of the valleys but where the valleys are deep and broad, and there was suitable rock beneath them, pressure tunnels were driven into the rock and lined with concrete. There are 17 miles of such tunnels outside of the city limits. Within the city itself, there is a pressure tunnel 18 miles long, running hundreds of feet below the surface.

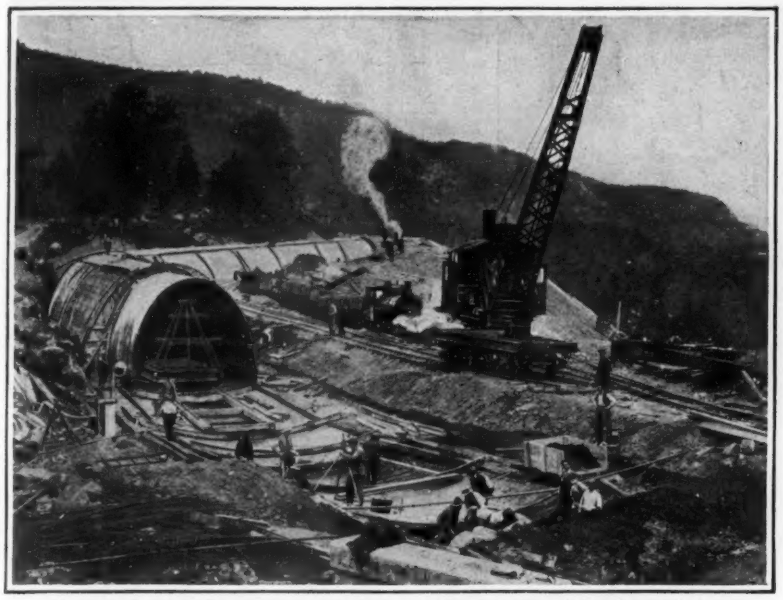
The most notable pressure tunnel is that which crosses the Hudson River between Storm King Mountain on the west bank and Breakneck Mountain on the east side of the river. In order to find suitable rock for the tunnel, it was necessary to go down 1,114 feet below sea level. To convey some idea of this enormous depth, it has been pointed out that if the Woolworth Building had its foundations at the bottom of the tunnel, its top would be far under the surface of the river, and another Woolworth Building could be built above it, the top of which would just reach the level at which the water flows away through Breakneck Mountain and continues on its way to the city. The shaft at the west side of the



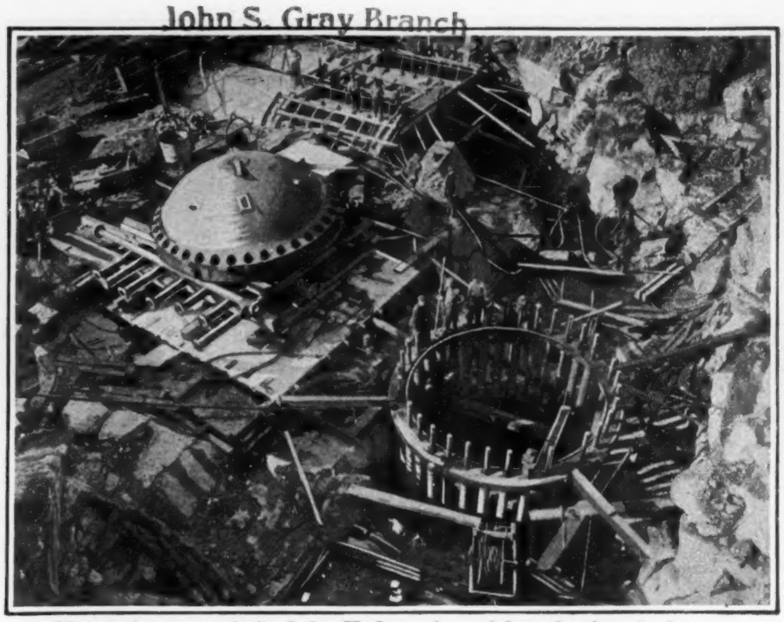
The waste weir and channel at Ashokan by which the flood waters of the reservoir are carried off



Water from Ashokan reservoir receiving an air bath before starting on its long journey to the city



Stages of cut-and-cover construction. In the foreground the invert is being laid, back of this is the inside steel form and farther back the outside form, beyond which is the completed aqueduct



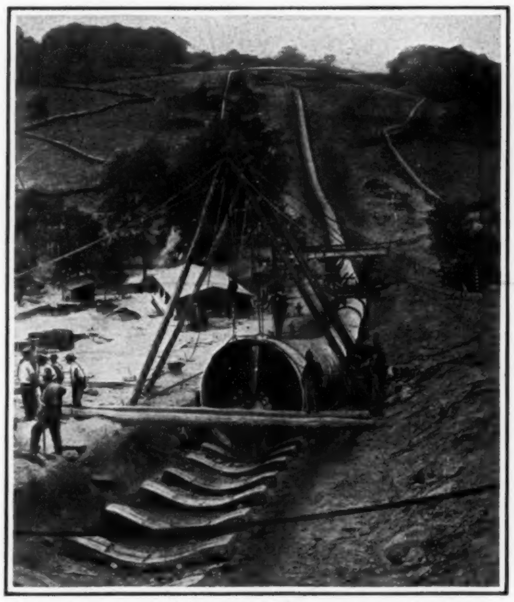
Mouth of the east shaft of the Hudson river siphon showing the heavy anchor bolts and, at the left, the massive cover, a 50-ton steel casting which the bolts are to hold down

river is closed by a deep concrete plug, but that at the east side serves as a drainage and access shaft, and hence it is furnished with a removable cover. This cover is in the shape of a huge dome, of cast steel which is held down by 36 anchor bolts of nickel-chrome steel, each 4½ inches in diameter and 50 feet long. These bolts are deeply embedded in the concrete lining of the shaft and serve to hold down the dome against the enormous pressure of 180 pounds per square inch, exerted by the water at this point.

Thirty miles from City Hall, the water enters the Kensico Reservoir, which is a lake of 38,000,000,000 gallon capacity, four miles long and about a mile wide. This lake will hold sufficient water to supply the city for several months, and hence will permit of closing down the aqueduct for inspection and repair whenever necessary. Just outside of the city limits there is another lake known as the Hillview Reservoir, the purpose of which is to equalize the steady draft from Kensico Reservoir against the hourly fluctuating demands of the city. And finally, at the extreme end of the aqueduct in Staten Island, is the small Silver Lake Reservoir, where a few days' supply of water is maintained as a local safeguard.

At a number of places in the Catskill watershed there are banks of very fine clay-like earth, some of which is carried into the reservoirs, making the water turbid. To correct this fault, a coagulating plant has been installed just north of the Kensico Reservoir, where a suitable coagulatant can be mixed with the water whenever necessary, which will probably be at long intervals. This will cause the fine clay particles to settle out of the water while passing through the reservoir. Down stream from the Kensico Reservoir there is a screen chamber where chlorine gas may be introduced into the water to destroy germ life. The gas is delivered at the chamber, compressed to a liquid state in steel containers holding 100 pounds each. The chlorine is introduced into the water through specially designed injectors and the gas may be introduced in any quantity up to 1,200 pounds per day, which is enough to sterilize as much as 350,000,000 gallons. Before the water reaches the city, it is practically sterilized and the gas is entirely neutralized and dissipated. In addition to this, there is provision for a filtration plant two miles below the Kensico Reservoir. Every precaution is thus taken to insure the purity and palatability of the water.

Out of the Hillview Reservoir the water plunges into



One of the steel siphons, showing manner of supporting the pipe on concrete cradles

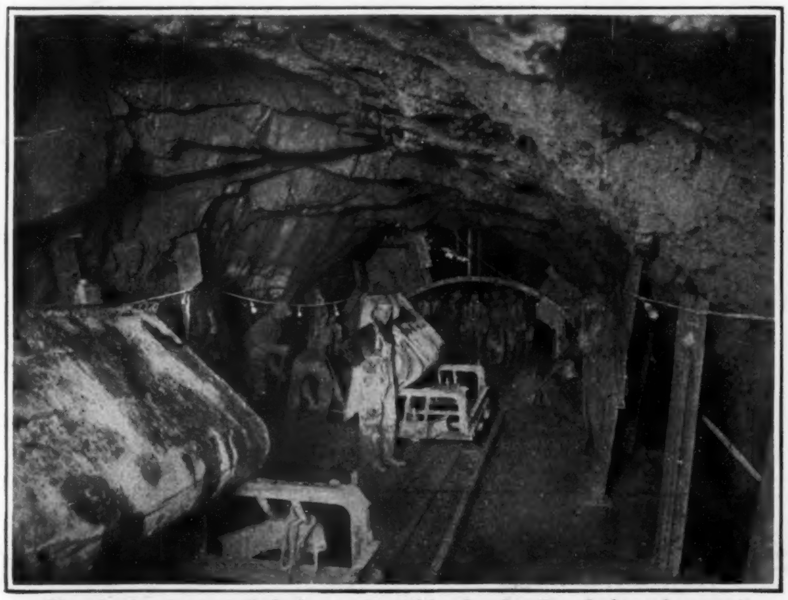
a tunnel hewn through solid rock under the city. The tunnel starts out with a diameter of 15 feet and terminates in Brooklyn, at the end of 18 miles, with a diameter of 11 feet. This tunnel lies from 200 to 750 feet below the street surface. The latter extreme depth was found necessary to carry the bore under the East River through sound rock all the way across.

This city tunnel was in itself a truly remarkable engineering undertaking. It involved the use of thousands of tons of dynamite which had to be handled with utmost care owing to the enormous possibilities of frightful disaster in so crowded a city. Yet the work was carried out without serious accident to any citizens and the general public had no knowledge of the work other than an occasional muffled blast under foot.

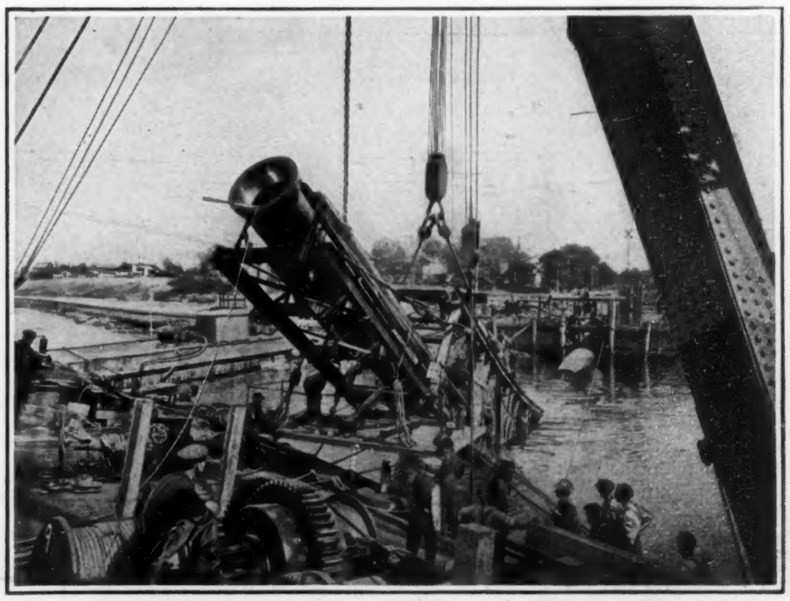
From the terminal of the tunnel in Brooklyn, there are two branches, one of which consists of a steel pipe line that extends into Queens, while the other proceeds through Brooklyn to Staten Island crossing the Narrows in a 36-inch flexibly-jointed, cast-iron pipe that is laid in a trench in the harbor bottom. In the shafts in the city tunnel there are bronze riser valves, 40 inches and 75 inches in diameter and section valves 66 inches in diameter also of bronze. The former are located about 100 feet above the top of sound rock and are designed to close automatically in case of an important break in the valve chamber or in the street mains, causing an abnormally large flow of water. They can be closed from within the chambers at the shaft tops. The section valves are located across the main tunnel and will permit the tunnel to be divided into parts and drained in sections without putting it entirely out of commission.

The new system is entirely independent of the Croton system, although the two may be used in conjunction. The Catskill water is delivered into the Hillview Reservoir at 295 feet above tide, while the Croton water is delivered in the Jerome Park Reservoir 134 feet above tide level, or 161 feet lower. The Croton water could only be delivered into the Catskill system by pump, but the Catskill water can be turned into the Croton Reservoir where it crosses at Jerome Park or at the 135th Street gatehouse, whenever necessary, although this, of course, would waste the advantage of pressure due to its higher level.

The cost of Catskill water supply development has, so far, amounted to $139,000,000. It is estimated that the Schoharie works will cost $22,000,000 more and the estimated total cost of the completed system will be about $177,000,000.



View in the city tunnel, during construction, showing the placing of concrete in the arch or upper half of the tunnel lining



Laying the siphon in a submarine trench across the Narrows. The photograph shows the start from the Brooklyn shore

Ballast unloader at work on light material

The left hand unloader handling rough material

Unloading Flat Cars with a Power Pusher

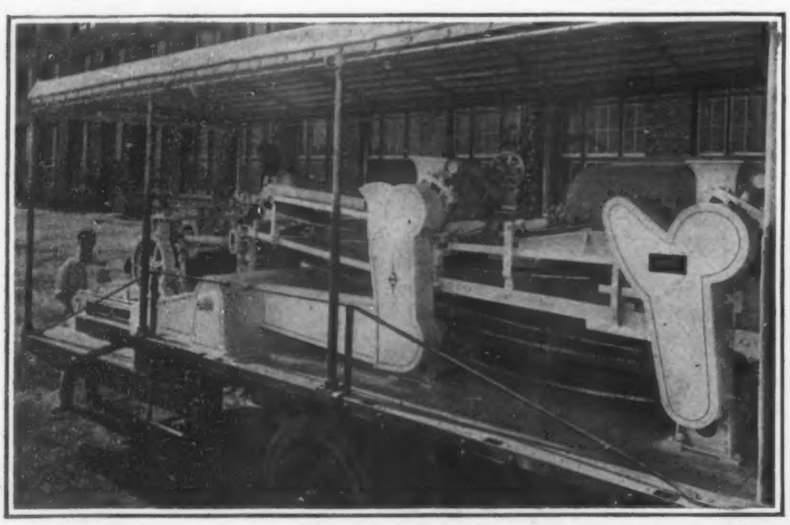
THE stroller along the railroad track who has watched a gang of noisy, swarthy sons of the Mediterranean shovelling sand, gravel, or rock from car to roadbed must have wondered that so primitive a procedure has been permited to survive so long. Such an observer will be interested to see the pictures which we present herewith of the up-to-date mechanical devices for doing this work. These ballast unloaders, as they are dubbed, reached the height of their development in connection with the Panama Canal task, and are now used extensively by railroads throughout the world.

The ballast unloader is designed only for use on flat cars or cars with hinged or removable side-boards, since their action is merely the sweeping of the car's contents over the edge, plow fashion. They are guided wholly by the stakes along the side of the car, no center rail being required; and on the ordinary flat car which travels without stakes, these must be inserted in the pockets before the unloader can be used.

Left hand ballast unloader being operated from a winding drum behind the locomotive

For the unloading of clay, loam, gravel and crushed stone, these ungainly sweeps have no close competition. Even in the plowing off the car of boulders and blasted rock they are serviceable; but for such use they must be of special strength, and great care must be exercised so to load the cars that the larger stones have beneath them a layer of smaller fragments upon which they can ride as the unloader urges them toward the jumping-off place.

Quite a variety of types is to be found. One form is planned for cars carrying ten cubic yards of material or less. Here the mold-board on the center plow is 24 inches high, with a tapering extension riveted to the top which makes the extreme height 37 inches in front and 26 behind. The same plow comes for right and left hand work with mold-boards of 36 inches, plus the extension. On cars of thirty-five to sixty cubic yards capacity plows are employed of approximately double this height. In every case the center, right hand and left hand unloaders are quite distinct. The first plows the material from the middle of the car out and off to both sides; the other two sweep it clear across from one side of the car and off at the other side, as shown in the close-up view. These right and left hand unloaders are not reversible, so that one can be made to do the work of the other only by turning it about and drawing it in the opposite direction along the car.



General view of the motor truck automatic bakery now being tried out by our Army Officials

A Transportable Army Bakery which Turns out 6,000 Loaves an Hour

WITH a crew of five men, the portable mechanical bread-making equipment recently perfected by two brothers, James and J. H. Garvey, has a capacity of 6,000 loaves an hour, which is a sufficient quantity for 30,000 men. But most important of all, perhaps, is the fact that this self-contained bakery is mounted on wheels —is, in fact, a motor truck—so that it may be readily transported wherever our soldiers go.

It is said that the brother inventors have succeeded in accomplishing what has heretofore been deemed impossible by bakers, namely, making up loaves of bread of various weights and shapes in a unit machine by a single, continuous operation. With the present machine it is possible to make up bread anywhere, either on the battle front, in the field camps, or at the cantonments; and with its crew of five men, including the truck driver, this equipment will do the work of over one hundred bakers working in the old way. The product is perfect bread, made in a scientific and sanitary manner. The mechanical process eliminates the very objectionable features of field bread today; that is to say, the unsanitary handling of doughs and the uncertainty of uniform output.

The military bakery on wheels consists of an automatic dough mixer, an automatic loaf divider and moulder, a full equipment of utensils such as pans, racks, flour bins and measures. At top speed it will make up from two to six thousand pounds of bread per hour. The machinery may be operated either by the power plant of the motor truck, or by electric motor where electric power is obtainable.

In a test of its mobility this military bakery recently left Los Angeles, under its own power, for Monterey, Cal., and the plans are to give it a thorough test at the Army Baker's School there, after which it is to be driven on to the San Francisco Presidio. The War Department at Washington, through Major General Liggett, Commander of the Western Department at San Francisco, has appointed two expert Army Bakery School Instructors at Monterey to accompany the machine upon its 500-mile test of mobility. Upon its arrival at San Francisco, a record in turning out Army bread will be attempted.

Cosmic Glass

NUMBERS of the fragments of natural glass known as Australites, which resemble the Moldavites of Europe, have been picked up in the hitherto almost unknown parts of South and West Australia traversed by the now almost completed Trans-Australian Railway. These specimens have now been found at stations scattered all over the southern half of Australia and also in the neighboring island of Tasmania. Those from the country along the new railway are generally found lying on the surface of the soil on the great lime-stone plateau over which the line runs for 500 miles. They are black in color and closely resemble obsidian in appearance.

A close view of the bread-making equipment which turns out 6,000 loaves per hour for the soldiers in the field

Why Cancerous Growth Occurs

By Maud DeWitt Pearl

TO the uninitiated, producing tumors in plants may seem a long way from determining how a tumor grows in human beings, but the scientist will credit such a feat as being of the utmost importance. The world is indebted to Dr. Erwin F. Smith, Pathologist in the United States Department of Agriculture, for having advanced our knowledge of this dread disease. His work, which has thrown light upon this problem from an entirely new angle, is based upon the theory that growth is the normal function of cells and that they are always multiplying except when they are inhibited by one thing or another. In other words, the reason why the cells of our body, or of any living matter, whether plant or animal, do not grow continuously, *ad infinitum*, is that they are held in check by various forces.

It was Dr. Smith's problem to find out whether when any of these inhibitors were removed growth would result. He conceives the work done by Dr. Jaques Loeb, of the Rockefeller Institute, on the growth and development of the unfertilized frog's egg, to be a case analogous to tumor growth. In these remarkable experiments of Dr. Loeb's he obtained so-called "fatherless" frogs merely by changing the surface tension of the unfertilized eggs. By a prick in the membrane, enclosing the living matter of the egg, sufficient stimulus was given to cause growth and development through the larval to the adult frog stage. Dr. Loeb showed that the sole cause of this development was due to the disturbance of the surface tension, which had been acting as an inhibitor to the growth of the cell contents.

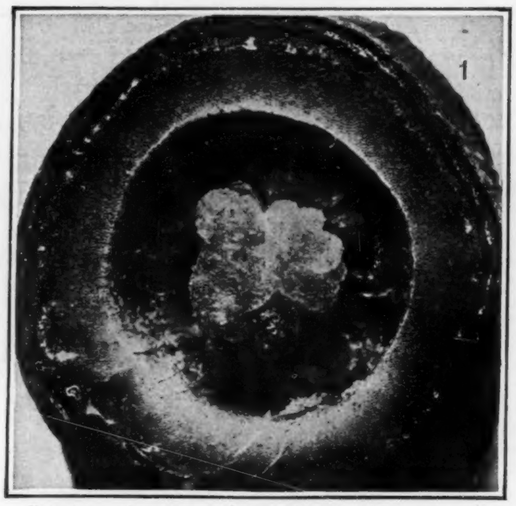
Dr. Smith believes tumor growth to be likewise a purely physical phenomenon. Any substance capable of disturbing the surface tension of living cells may, he considers, bring about a multiplication of cellular tissue; this growth is then a result of the increased osmotic pressure which causes a movement of water and foodstuffs into the affected area.

To prove his theory Dr. Smith sought to determine what effect substances produced by the bacteria that cause plant tumors would have upon healthy plants. It is interesting to know that a stimulus to this work was given to Dr. Smith at least fifty years ago when in his boyhood he read (and proved by experiment to be true) a statement that the germination of the coffee bean, which is exceedingly slow, would be accelerated so that it would occur in a few hours' time by immersing the seed in strong ammonia water.

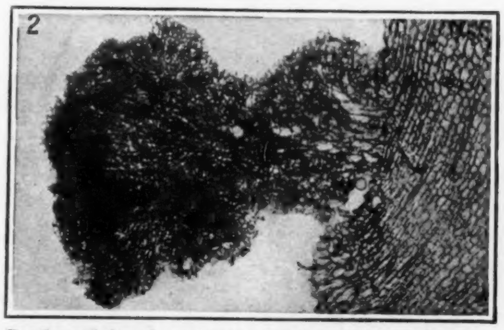
Dr. Smith has now been able, by the use of ammonia, which is a product of the metabolism of bacteria and other parasites, to produce cell growth in plants where under healthy conditions it would not occur. He used chiefly in his experiments the castor oil plant, injecting into the hollow stem fluids of varying strengths. By this method the inner walls of the cells of the tube were bathed with the solution. Growths of these cells into the hollow stem resulted which were tumor-like in every way. The many experiments checking the results indicated that the rapid growth of the cells was due to no other cause than a change in the surface tension; or, in other words, a removal of the growth inhibitors.

By using other substances than ammonia salts, Dr. Smith has found that plant tumors may be caused by the action of many dilute acids including such substances as may be produced by various bacteria, larvae of gall flies, and other parasites. As with ammonia, the indication is that these do not cause the rapid cell growth by their chemical reaction upon the contents of the cell but by changing the physical condition of the cell walls and thus increasing the osmotic pressure from the surrounding cells.

Dr. Smith argues that if wood and bark and organ fragments of all sorts can be developed out of place in plants by local stimulus (and this he has done in his experiments) why not also in the same way cartilage, bone, muscle and foetal fragments out of place in animals? And certainly it is not too far a cry from this work to the control of abnormal growth in animals.



Cut stem of castor-oil plant showing tumor growth in center



Section of the above tumor showing, at left and center, multiplication of cells from normal tissue on the right

Studying the Science of Evaporation

INVESTIGATION of another factor affecting weather, that of evaporation, is being undertaken by the United States Weather Bureau. While for a number of years the bureau of course has been making some observations along this line, the past year marks the establishment of a number of small evaporation plants at various stations in the country. It is now proposed to keep detailed records of evaporation at these places in much the same way as temperature and rainfall records. The Division of Dry Land Agriculture Investigations of the Department of Agriculture has also been making a study of the same problem in certain localities, its work dating back to some years ago. At some stations, as at Lincoln, Nebraska, where the illustrations were secured, the two styles of equipment have been installed side by side.

For its new work the Weather Bureau has devised a standard type of plant, which can be manufactured at low cost and which will insure uniform observations in all parts of the country. The main part of the equipment consists of a galvanized iron tank, four feet in diameter and ten inches deep. In order to provide an unruffled water surface when the measurements are taken a metal tube, or well, is kept standing in the tank. Of course it is open at both ends so that water rises to the same height in the tube as it does in the tank, but naturally it is not affected by the wind. It is an easy matter to reach down in this tube with a measuring rod and get the depth of water. By taking readings at regular intervals the amount which has evaporated can be determined. Of course in case of rain proper deductions must be made and for that reason a rain gage forms part of the equipment. A wind gage, or anemometer, is mounted at one side of the tank and maximum and minimum thermometers are also provided in an enclosed shelter.

The equipment used by the Division of Dry Land Agriculture Investigations and occasionally installed side by side with the Weather Bureau equipment has a device which records on a sheet of cross-section paper the evaporation as it is taking place. At the end of a week the observer has a complete graphic record of the water loss from day to day. The tank used with this equipment is about three to four times as large as the standard Weather Bureau tank, and is placed in a depression so that the top is on a level with the ground. Evaporation from it represents more nearly conditions

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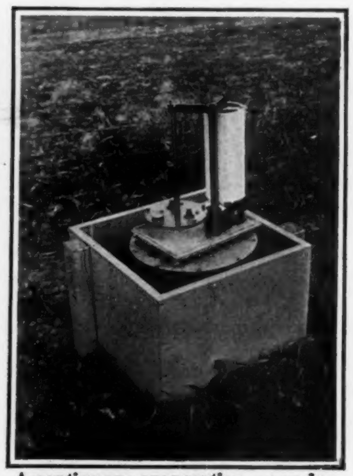
Measuring evaporation; the surface is always level inside the tube



A continuous evaporation recorder

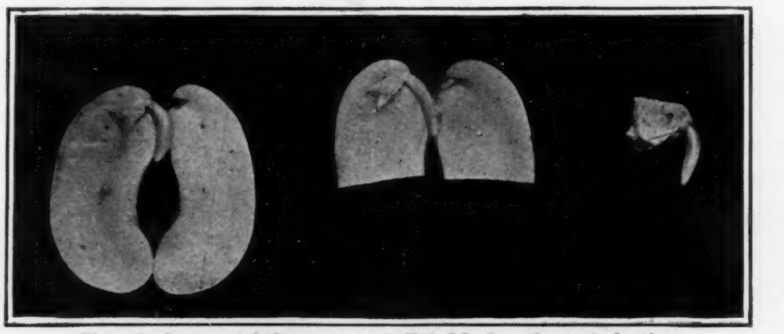
Are Cotyledons Essential?

SOME interesting experiments have been carried out recently in connection with the cotyledons of Kidney Beans (*Phaseolus vulgaris*). These prove that, although the cotyledons are helpful in the development of the baby plant, yet they cannot be considered to be essential, the youngster can develop without the aid of the starch stored away in the lobes.

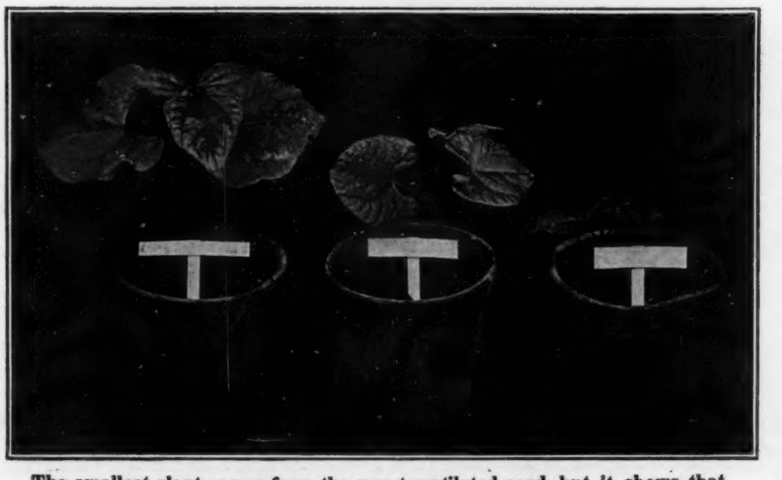
Three beans were selected for a very remarkable test. In the first case the bean was sown without any interference; in the second instance the cotyledons were halved, while, in the last case, the cotyledons were entirely removed save only a tiny portion that adhered to the embryo. All the beans were sown under similar conditions, and the outcome can be gathered by a glance at the accompanying photograph.

It is seen that the development of the plant is inferior where half the cotyledons had been taken away, and more so still in the case where these processes had been entirely removed. But in both instances where the cotyledons had been mutilated the plants were perfectly healthy, proving that the cotyledons are not by any means essential to the growth of the young plant.

Germination in the case of the untouched bean was much slower than with those that had been treated. The bean without cotyledons was a little plant almost before the normal specimen had properly germinated. It seemed as if the embryo realized, if one may use the word, that it had no food supply to draw upon and must therefore get its leaves and roots developed at the earliest possible moment.



How the bean cotyledons were mutilated before the test planting



The smallest plant comes from the worst mutilated seed, but it shows that the cotyledon is not essential to growth

Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

The original of this engraving consists of six exposures, each 3¼ by 4¼ inches, made with the special back and the tripod plate

Why Not Make Panoramic Pictures with Your Folding Camera?

YOUR folding camera is now available for making panoramic pictures. The latest method of making such pictures calls for only a few minor changes in the removable back of the conventional hand camera, and a double disk of some aluminium composition. The changes in the back do not add either weight or bulk to the usual instrument; and since the disk is approximately ⅝ inch thick by five inches in diameter, it will readily slip into any ordinary coat pocket. Aside from its inexpensiveness, the new method of making panoramic views is simplicity itself: it calls for nothing more than the making of a number of successive pictures in the usual manner.

There are no automatic features incorporated in the new device, yet the work it produces is comparable to that of the most expensive panoramic cameras. Furthermore, although it makes it possible to take panoramic views varying in angle from 90 degrees to a complete circle of 360 degrees, the same camera is instantly available for the usual run of work.

Considering, first, the new back, it will be noted in one of the accompanying illustrations that this can be made from the usual back by providing two holes as shown. Straight edges are inserted, their distance apart being approximately the length of the metal mat of the instrument. These are shown at *E* and *F*. At *G* is a rectangular hole for observing the number of the film when the camera is used for panoramic work.

The aluminum disk is shown at *C* and *B*, and is accurately turned up. The part *C* has a small stud located centrally in it, which screws into the camera in the usual tripod hole; in this manner the camera and the upper part of the plate *C* are securely held together. The lower part of the disk *B* screws onto the tripod. A turned extension on *B* fits accurately into a running bored fit in *C*, so that the latter can be turned accurately upon *B* and concentric with it. On the chamferred edge of *C* and *B* are graduations, these being in distance apart equal to the lens angle when the camera is focussed at infinity. There can, of course, be other graduations for different focal lengths, if this is desired. This is made necessary, since, with an increasing focal length the lens angle decreases.

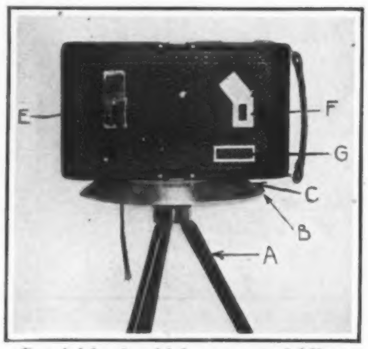
After setting the apparatus up as shown in the illustrations, the camera is made level as near as possible. This can be done with the eye with sufficient accuracy. The camera is now swung by its turn table to the extreme left end of the desired picture, then, after turning the lower disk *B* so that one of the lines exactly coincides with zero, or starting point on *C*, member *B* is made tight on the tripod by means of the tripod screw.

An exposure is now made in the usual manner. Following this, with a sharp-pointed pencil close against the straight edge at *E*, a line is drawn. The film is then wound until the pencil line appears at the opening *F*, and the winding is continued until the line is nearly under the second straight edge at *F*. One does not have to wind carefully until the next film number appears in the extreme left end of the rectangular opening *G*, which indicates that the line is approaching *F*. After the first picture has been taken, the exposure numbers will not appear in the usual indicating hole, for the distance from picture to picture is less owing to the fact that there is not the dead film space which exists when taking single pictures. The opening *G* also serves the purpose of showing the operator how many exposures have been made. For example, after the first exposure is made and the film wound up, number 1 will appear at the extreme right of *G*, number 2 after the second exposure will appear about ⅜ of an inch from the right end, and so on as the pictures are taken.

The second step is to swing the camera and *C* together so that when standing behind the camera the lens is moved to the right. This operation is stopped when the index line on *C* is alined with the second division line of *B*. Now the second picture is made, and after marking the film as before and swinging to the next division, the operation is repeated. So in this manner the panoramic picture can be made with two, three, four, five or six exposures, covering any angle up to 360 degrees or a complete circle.

As will be noted by the sample shown herewith, a series of photographs are taken by swinging the camera and matching the ends, in this manner forming a polygon and not a circle as in the usual panoramic camera. Each picture is a perfect picture and has not the general distortion so noticeable in the conventional panoramic photograph. There is a fine gray line produced where the pictures come together, but even those who are only after the artistic effect cannot object to this feature. For the many individuals who have been looking for years toward the development of some simple means of taking this class of photograph to be used in connection with their work, this fine line will never be noticed.

Front view of panoramic camera and tripod base-plate



Special back which converts folding camera into panoramic type

The originator of the new method of making panoramic photographs, Geo. S. Blankenhorn of Milwaukee, Wis., has spent considerable time and money in the last few years, perfecting this method and the necessary apparatus. As a result it is said that the views which can be produced are highly satisfactory.

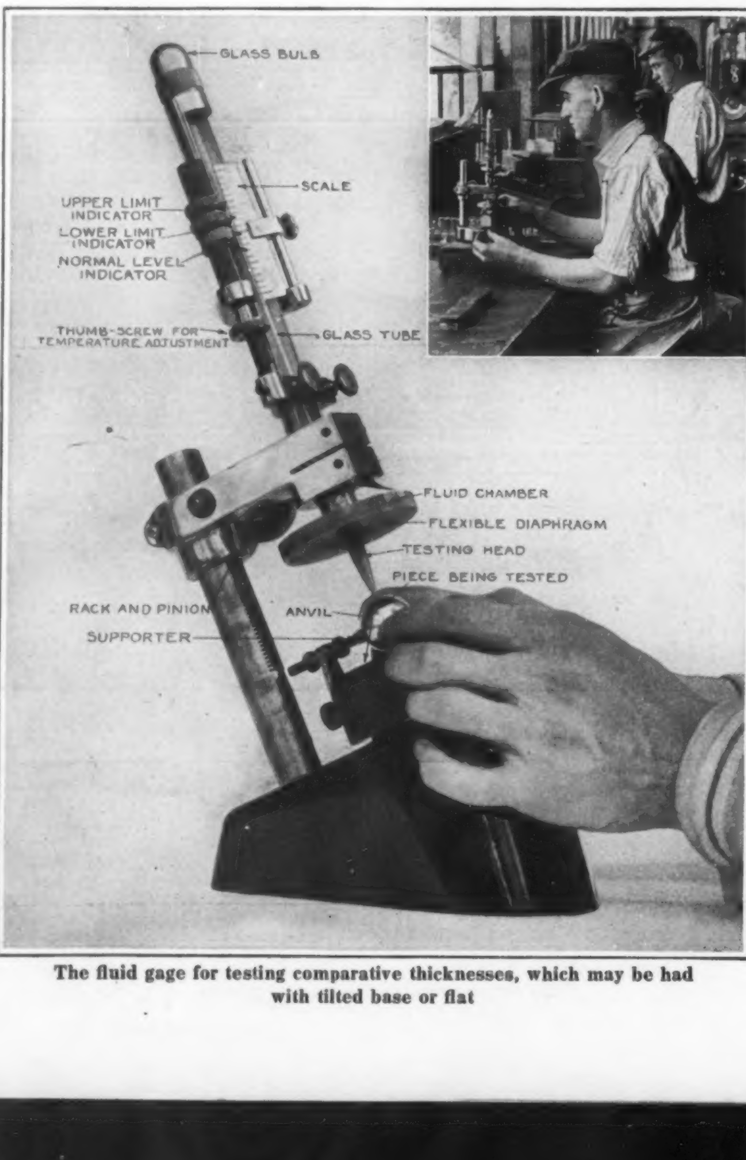
Tested to One Ten-Thousandth of an Inch

MICROMETER and snap gage are excellent tools; but they often leave much to be desired. In shop inspection of hundreds or thousands of identical parts, we may r asonably demand something that takes fuller advantage of the fact that this is repetition work—something faster in operation, something providing a more nearly automatic comparison with the standard; above all, something eliminating the sense of touch, doing away with the necessity that the operator carry in mind a certain degree of pressure which must be applied to or received from each piece, and getting away from the great difficulty in reconciling the results obtained by different operators.

A wholly novel gage is now on the market which seems to fit in with these demands to a nicety, and which is giving supreme satisfaction to an ever increasing array of users. More work and better work in less time is the claim which is made and supported for this new gage. It does not attempt to measure absolute diameters, but merely betrays the amount by which each piece exceeds or falls short of the standard. It is not even necessary that the operator know, in inches or millimeters, what that standard is, provided he has a sample known to conform with it.

The fundamental departure of this gage is that, while it works through the medium of the pressure delivered by the piece being tested, the operator is not required to feel that pressure. Instead he actually sees it, thrown up before his eyes on such a scale that he can hardly find a way to go wrong. A glance at our picture will make it clear how this is brought about.

The fluid chamber, filled with a colored liquid, has its lower surface in the form of a flexible diaphragm. It is connected with the glass tube, so that any pressure on the diaphragm forces the fluid up the tube. By moving the whole upper part of the apparatus up and down on the rack and pinion, by screwing the fluid chamber separately up and down like a micrometer head, by removing or adding fluid through the glass bulb at the top of the tube, and by sliding the scale up and down, the gage may be adjusted so that, when a standard reference sample of the piece to be tested is placed on the anvil and in contact with the testing head above, the fluid level in the glass tube is precisely even with the zero mark in the center of the scale. Then the two limit indicators, which may be moved separately or in unison, are set according to the scale, so as to mark the limits within which variation of the piece in question may be tolerated, and the gage is ready for the day's work.



The fluid gage for testing comparative thicknesses, which may be had with tilted base or flat

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The Current Supplement

In these days of refined technical processes there are many operations where heat is employed in which it is necessary that either the temperature in an operation be accurately known, or that it be limited within specified limits, and for this purpose instruments known as pyrometers are used. But it is not generally appreciated that these instruments do not indicate the actual temperature, but are rather instruments of comparison, as their scale is graduated in accordance with a datum which is separately determined. The article on *The Measurement of High Temperatures* in the current issue of the Scientific American Supplement, No. 2182 for October 29th, discusses this problem, and that of determining a standard of comparison. After the war there will be a large number of crippled soldiers whose claims for pensions or insurance payments will have to be determined, and the old method of personal opinion of a board of doctors is decidedly unscientific, and frequently unfair to both parties. The problem has already been studied in France, and ingenious instruments devised by which the actual conditions are visibly recorded, thus giving an unvarying basis for decisions, and avoiding disputes, both present and future. The system employed is briefly described in the article entitled *Testing War Cripples*, which is accompanied by illustrations of the apparatus used. *Italian War Engineering* notes a remarkable feat accomplished on the Southern front, and is illustrated by two pictures. *The Scientific Detection of Crime* tells of some of the newer methods now used which may be of great importance. *The Field of Vision* discusses the effect of harnessing up indirect vision on the eyes. *Wild Mushrooms* tells of a natural product of great value as an addition to our food supplies, and is accompanied by a large number of excellent illustrations. *Ship Model Experiments* describes the results of their application to full-size construction. *The Development of the Coherer* reviews something of the history and theories of an instrument employed in wireless telegraphy and is accompanied by several illustrations. The paper on *The Brown Coal Distillation Industry in Germany* is concluded. Another interesting paper is on the *Inadequacy and Inconsistency of Some Common Chemical Terms*. There are a number of other articles of value.

The New War Truck

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to four weeks job. Continental completed the pattern for the cylinder pairs in slightly over five days, an accomplishment best appreciated by engine manufacturers.

Showing the coöperative talent employed, it can be said that the crankcase is Continental, the cylinders Waukesha, the oiling system a combination of Wisconsin and Buda, the pistons Hercules, the timing-gear system a combination of Buda, Wisconsin and Continental, governor a combination of Kelly-Springfield and Waukesha, and the camshaft a composite, as is the transmission, the axles, and other parts.

So confident are both the Quartermaster Department, the Society of Automotive Engineers, and the Council of National Defense that this truck is as good as it can be made, that orders for parts for 10,000 of them have been placed. More than sixty manufacturers have participated, groups of three or more generally receiving orders for the different parts. No difficulty is being experienced in getting the orders filled—the manufacturing capacity available to make these trucks is double that required, and there are more concerns anxious to coöperate than there are orders to go 'round.

General Baker, for long a student and an enthusiastic advocate of adequate army motor transportation, has been at the head and front of this manufacturing, inventive, designing achievement, and by his knowledge and enthusiasm has done much to make it a possibility. But General Baker has publicly and with the utmost sincerity put the whole credit for making this truck where it belongs.

"It is the work of the Society of Automotive Engineers" he has said, very simply. "They did it. They have long been friends of the War Department and lately have coöperated most extensively. Now they have given their time, ungrudgingly, their secrets, worth streams of gold, without compensation, their effort, their knowledge, their enthusiasms, for patriotic motives alone. They have done a big job, and while it is probable that the full story of their sacrifice, their patriotism and their wonderful achievement will never be wholly realized by the public at large it will never be, can never be, forgotten by the soldiers it arms with a better arm than any other country possesses. I cannot make it too strong that the S. A. E. has done a wonderful work, in a wonderful way, and produced a wonderful result."

Studying the Science of Evaporation

(Concluded from page 315)

existing when water is evaporated from the soil, while the Weather Bureau tank, being slightly elevated, represents conditions in the air. The self-recording device is located some little distance from the large tank, being connected with it by an underground pipe. The level of the water in the bottom of the recording machine naturally remains on a level with the water in the tank. A float rests on the water level in the recorder, and as the water in the tank evaporates the float of course gradually descends. This movement of the float is communicated to a pen which marks the change on a revolving roll of paper, the cylinder of paper being turned by means of clockwork.

The science of evaporation has become important in recent years. The engineer is interested in the amount of evaporation from large surfaces of water, such as reservoirs, while the agriculturist desires to know the evaporation from the moistened surface layers of the ground. Even the plant physiologist finds it necessary to understand the science of evaporation as applied to the leaves of plants. And of course evaporation is a vital factor in weather, so there are many ways in which the new study will prove useful.

Tested to One Ten-Thousandth of an Inch

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It is especially to be noted that the limits need not be equal. Thus we can set the gage to limits of plus $\frac{4}{10,000}$ and minus two of these infinitesimal fragments of an inch, just as readily as to limits of "plus and minus three." The scale is graduated into ten-thousandths, the circular top of the fluid chamber into thousandths. By controlling the diameter of the glass tube, the scale spaces may of course be made as wide as desired. Ordinarily they run from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch; and in every case the scale is good only for the tube with which it is sold, and to which it has been calibrated with the utmost care. It is the fact that pressure at a single point of the diaphragm causes a rather extensive "dent" in its surface, as much as the small diameter of the tube, that brings it about that the variations in thickness of the piece being tested, as transferred to the fluid height in the tube, are magnified from six to twelve hundred times.

The man at the fluid gage can inspect his pieces as fast as he can handle them. He slides them in and out of the space between the anvil and the testing head, with a supporting backstop to prevent their going too far if their shape is such as to make this desirable. In every case the fluid leaps upward in the tube, since the apparatus was so set up that the standard piece itself exerted a certain pressure against the testing head, which in the absence of any piece at all is removed, in the presence of any piece restored—with variations. Here it is to be emphasized again and again that we have no plunger action, with its many difficulties of adjustment and operation; we are simply displacing by direct pressure a solid mass of fluid—and measuring the displacement quite automatically.

If the top of the fluid column halts between the two limit marks, the piece

comes out as fast as it went in—tested and passed. If the fluid leaps over the upper limit, or fails to reach the lower one, the piece is large or small, and is as promptly rejected. In either event the decision of the inspector is an instantaneous one, and is bound to be correct, for visibility is high. The limit pointers are black, the fluid is a bright red or violet; and the very fact that there is a sharp motion to watch for makes reading easier than when a fixed mark has to be located and identified. Yet withal there is no danger of the instrument running away from the operator, for if at any time he is in doubt he can arrest the motion and hold it at its limit by simply refraining from snatching out the piece being tested until he is satisfied.

In its details and its fittings the fluid gage is as well worked out as in its fundamentals. It is recognized, for instance, that temperature in the testing room may not be constant. This is met by use of the normal level indicator, set at the beginning to mark the point to which the fluid falls when the anvil is empty. If at any time the column drops below this mark or fails to reach it, expansion or contraction is indicated, and is at once compensated by raising or lowering the thumb-screw carrying the three indicators.

For most purposes the makers recommend the tilted stand for the instrument, as giving a better view of the whole outfit; this is one of the features added as the result of working experience. Another detail that has called for considerable designing acumen is the testing head. The long thin head used for testing balls is not suited to every purpose; each piece has to have its own particular shape. Starting with three or four types, the makers of the gage have allowed their customers' needs to regulate the adding of new heads to their line, until now they offer a great many different patterns. Perhaps the most ingenious is the one for testing the annular ball race—a heavy ring with a grooved track on the outer circumference in which ball bearings run. The head for this consists of a ball just fitting the race, held by a little collar that partly encircles it, gripping it just beyond the center line. Other curious types showing knobs and balls and flat or curved contact surfaces of varying degrees of eccentricity, are made for other applications.

We cannot close this account without remarking the fascination with which we watched the thin red column bob up and down as the gage was exhibited to us in action. It is advisedly that we have employed the term "leap" to describe this; nothing else would do justice to the alacrity with which the telltale line of color responds to the high spots and the low spots of the object placed upon the anvil. It makes a deviation of a ten-thousandth of an inch visible all over the room.

Trade Marks in the Orient

THE trade-mark laws of most foreign countries, especially of Japan and China, differ materially from those of the United States. In Japan, trade-mark rights are acquired by registration and not by priority of use. Not only is an American exporter who has omitted the formality of registration without trade-mark rights in Japan, but, what is even more important, other persons may acquire property rights in his marks by the simple expedient of forestalling him in registration. Every American who is exporting goods or who expects to export goods to Japan should accordingly make certain that his trade mark is properly entered on the Japanese trade mark records and that his rights, once acquired, are maintained.

In China there are no national laws for the registration of trade marks. It is the custom for exporters to register their marks at their own consulates, and this often leads to more than the ordinary extra-territorial confusion. In practically every case a foreign infringer of a trade mark in China insists that the question be adjudicated under the laws and by the consular courts of his own country. When

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Foreign Commercial Notes and Queries

The Scientific American has always enjoyed a wide international circulation. Its voice is heard in the remotest corners of the earth. Now that American manufacturers have been stirred to the advantages of international expansion we are anxious to do our part in bringing American products into foreign markets. Hence this department has been established to pave the way for American trade expansion to all quarters of the globe.

Those who are interested in the trade opportunities listed in this column, can obtain the names and addresses by complying with the following simple rules: 1. Write only one inquiry on a sheet. 2. Always give the serial number. 3. Write on your own business letterhead. The Scientific American assumes no responsibility for the financial standing of concerns or individuals. Address all communications to the Query Editor of the Scientific American, Woolworth Building, New York.

682.—A firm in Spain desires to represent American manufacturers and exporters of industrial machinery of all kinds, such as chemical apparatus, refrigerating plants, diving and submarine apparatus, and boiler equipment; building machinery, such as cranes, molds for making artificial stone, tools, diaphragm pumps, etc.; traction machinery for fishing boats; public service supplies, such as cleaning apparatus for streets, sprinkling wagons, night-soil wagons, fire-fighting appliances, hand pumps, extension ladders, and all kinds of firemen's apparatus; ovens for slaughterhouses, hospitals, etc.; complete slaughterhouse equipments; complete scientific laboratory equipment; hygienic and disinfecting apparatus or hospitals, etc.; washing and ironing machinery; electromedicinal equipment, ncluding X-ray apparatus, etc.; fireproof roofing tiles; dairy equipment; and veterinary instruments of all kinds. References.

683.—A wholesale buyer in Italy is in the market for all kinds of lavatory and sanitary equipment for closets, basins, lavatories, etc., made in enameled cast iron and fire clay. He also wishes to buy bath-water heaters using gas, petroleum, wood, and electricity. Payment will be made by opening credit at local bank when giving order, available against shipping documents. Correspondence may be in English. References.

684.—A company in Denmark wishes to buy 200,000 pairs of rubber shoes of good and medium quality. Quotations should be made f. o. b. nearest American port. Payment will be made by cash against documents. The shoes should be packed 50 pairs to the case. Correspondence may be in English. References.

685.—An agency is desired by a man in Spain for the sale of mineral oils. Correspondence should be in Spanish or French. References.

686.—The general manager of a firm in British East Africa wishes to be placed in communication with American manufacturers and exporters of tobacco, cigarettes, and cigars; cutlery; crockery; glassware; enamel and aluminum ware; lamps; sponges; stationery, such as writing paper, inks, playing cards, novels, books, etc.; watches and timepieces; toilet articles, such as perfumery, soap, etc.; haberdashery, such as hats, caps, hosiery, shirts, collars, ties, boots and shoes, etc.; house furnishings, such as drapery, cretonnes, art muslins, bed sheets, pillows, pillow cases, bath towels, table linen, rugs, blankets, etc.; groceries; sugar, flour, rice, etc.; wines, spirits, ales, etc.; and especially very cheap planters' tools, alpacas, prints, aluminum ware, etc. The firm will make outright purchases and also consider agency propositions, depending on nature of the goods desired. References.

687.—A man in Mexico wishes to receive catalogues of soap-making machinery; bottles and containers of flint and opaque glass for perfumes, cold creams, talcum powder, and other toilet articles; lithographed labels, without gum; and aluminum tops for containers. Correspondence.

688.—The New York representative of a shipbuilding company in France wishes to receive specifications and complete information relative to an up-to-date shipbuilding plant, including machinery for handling the crude ore, the making of steel, and manufacture of plates, shapes, etc., also the machinery for engine building and other necessary equipment. Delivery will not be required until after close of war.

689.—A firm in Genoa is in the market for sal ammoniac and carbonate of ammonia. Correspondence should be in French or Italian. Reference.

690.—A man in France desires to purchase, complete, machinery and equipment for reëquipping a flour and meal factory. He also wishes to buy baker's machinery. Payment will be made by cash against documents. Correspondence should be in French. References.

691.—A firm in Italy desires to secure an agency for the sale of small hardware, scissors, pocket knives, white metal wire and ribbon for electrical purposes, plain tooth saws for wood, pincers, bits, steel measures 10 to 20 centimeters long with indications of millimeters, ordinary and patent locks, screws, files, and razors. Correspondence should be in French or Italian. Reference. Catalogues and samples should be submitted, wherever possible.

692.—A company in Italy is in the market for large quantities of all kinds of metals, especially iron tubes, brass, and copper. Correspondence should be in French or Italian. References.

693.—A man in France wishes to represent American manufacturers and exporters of steam engines and equipment and tools of all kinds. Catalogues, terms, price lists, and full information should be submitted. Correspondence should be in French. References.

694.—An importer in British East Africa desires to buy very cheap hoes, made of good steel and proper thickness, the blade to be heart-shaped, about 7 by 6 inches with a strength flat shank fitting into a wooden handle, the whole hoe being flat and made of one piece of steel. A large number of these can be used annually, if prices are reasonable. Payment will be made by sight draft with bill of lading attached, or by cash in New York, if absolutely necessary. Goods should be packed in extra strong cases or crates. Reference.

695.—An agency is desired by a man in France for the sale of industrial supplies, such as small tools, leather belts, rubber goods, glassware for industrial purposes, etc. Correspondence should be in French. Reference.

696.—A man in Italy wishes to secure an agency for the sale of marine glasses, prismatic glasses, optical instruments, engineering, surveying, and nautical instruments, etc. Catalogues should be submitted. Payment will be made by opening credit with New York bank, if necessary, or by deposit. Correspondence should be in French or Italian. Reference.

Trade Marks in the Orient

(Concluded from page 318)

the owner of the mark and the infringer are of the same nationality, there is no difficulty; and even when the infringer is a Chinese, it is possible for the owner to prevent violation of his rights. The difficulty arises in cases where owner and infringer are citizens or subjects of different nationality, and this is aggravated when the infringer is of a nation, such as Japan, in which no property rights in trade marks are recognized prior to registration.

While in Japan property rights in trade marks are acquired by registration, in the United States these rights are obtained by use of the mark in trade. If Japan a d the other countries with similar laws would only look at the other side of the question, there would be a happy ending to many controversies. If a Japanese should register his trade mark in Japan prior to its use in trade by an American, by all means the rights of the Japanese should prevail in China, and the United States as well as the Japanese Consular Courts should respect such rights. But should the American acquire rights in a mark by priority of use before the registration of the mark in Japan, then the rights of the American should rule in the Consular Courts. There would be no hardship on the Japanese merchant under such rules of reciprocity, for there is never any considerable interval between use and registration of a trade mark by Japanese merchants; they recognize the necessity, under their laws, of prompt registration.

The fact that reciprocal trade-mark rights were recognized by Japan in China would not affect the question of trade-mark property in Japan; it would still be necessary for American merchants to comply with the Japanese laws to prevent the infringement of their rights in that country. But until the Japanese feel disposed to reciprocate in trade mark matters in China, American merchants who wish to protect their trade-mark rights in the Celestial land should not only take steps to register these marks at the American consulate, but should also make certain that application for registration in Japan be filed without delay. The whole matter, in fact, should be placed in the hands of lawyers who are familiar with the conditions and the foreign trade-mark laws, and their advice should be followed. Otherwise the originator of a valuable trade mark is liable to find himself, so far as the Far East is concerned, in the position of the purchaser of a house and lot who thought he could draw up a deed without consulting a lawyer, and who eventually discovered that all he had bought was a lawsuit against the seller's wife, whom he had left in full possession of all her rights in the property.

Legislation Affecting Wartime Patents

A BILL now pending before both House and Senate provides that whenever, during a time when the United States is at war, the publicatior of an invention by the granting of a patent might, in the opinion of the Commissioner of Patents, be detrimental to the public safety or defense or might assist the enemy or endanger the successful prosecution of the war, the Commissioner may order that the invention be kept secret and withhold the grant of a patent until the termination of the war. If, however, during the period of suspension, the invention be published or a patent application be made in any foreign country, without consent of our Patent Commissioner, all rights may be held as forfeited. A patent being held under suspension according to the terms of the bill, it is provided, may be tendered the Government for its use during the war and before issue; and in this case the inventor shall, if and when he ultimately receive a patent, have the right to sue for compensation in the Court of Claims.

It would seem that this bill accomplishes the purposes for which it is obviously intended, and that at the same time it affords ample protection to Government and inventor alike.

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